ELECTRICAL REVIEW

OCTOBER 1956

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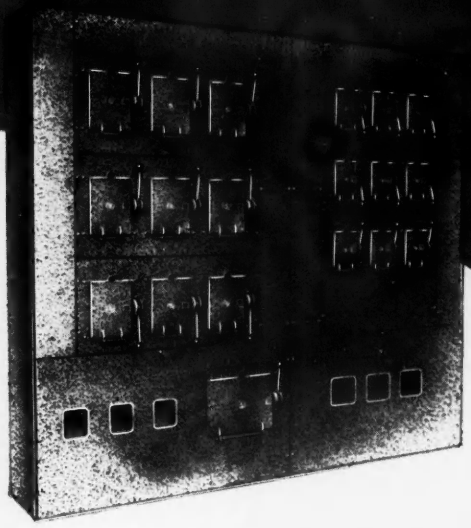

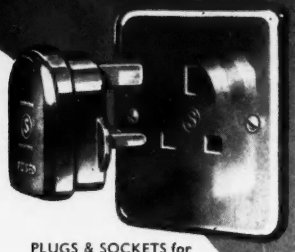

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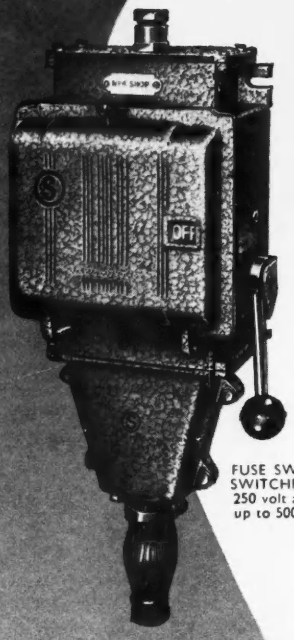

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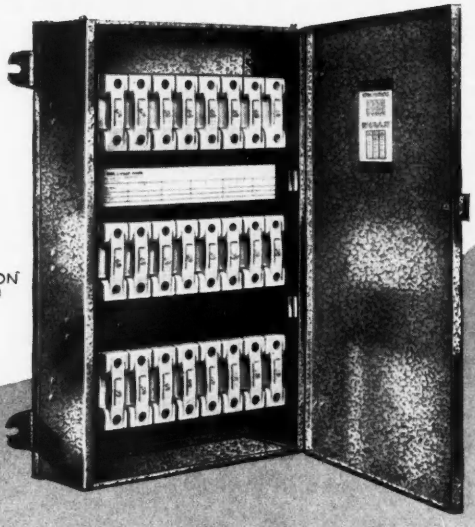

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5 OCTOBER 1956

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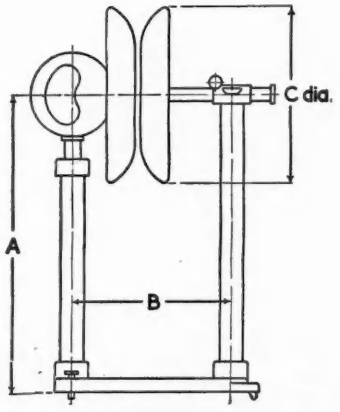

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ELECTRICAL REVIEW

5 October 1956 Vol. 159 No. 14 Established 1872

Plant from America?

LORD CITRINE, the chairman of the Central Electricity Authority, announced last week that it was the Authority's intention to invite tenders for large transformers from three American manufacturers. One of the recommendations of the Committee of Inquiry into the Electricity Supply Industry (the " Herbert Committee ") was that if the invitation of foreign tenders for plant would " induce keener trading from home manufacturers " the Central Electricity Authority and Electricity Boards should invite such tenders unless they were forbidden to do so by the Government. The Committee implied that the Authority was not getting the best terms from British manufacturers and criticised it for not ascertaining whether the Government would permit it to invite foreign tenders.

It also made comments on the Heavy Electrical Plant Consultative Council which were strongly resented by British electrical manufacturers. The Committee attributed the Council's attitude towards foreign tenders to the preponderance in its membership of British plant manufacturers, but in its 1955-56 Report the British Electrical and Allied Manufacturers' Association pointed out that Government representation on the Council was particularly strong, apart from C.E.A. and trade union membership.

The B.E.A.M.A. contended that the manufacturers, like the other members, regarded the policy agreed by the Council to be in the best interests of the country. They accordingly had invested the necessary capital in research and productive resources for generating plant for export as well as for the needs of the C.E.A., two vital considerations. If those resources were not fully used production costs must rise. British manufacturers were not afraid of foreign competition either abroad or at home—if that competition was fair and based on the domestic prices of the country of origin.

Justification for this claim is forthcoming in the successes which British manufacturers have achieved, notably in the United States itself. In spite of the " Buy American " Act, which gives a substantial margin of preference to United States manufacturers in their home market, import duties, and some national prejudice, leading British turbine, transformer and switchgear manufacturers have secured substantial orders.

American producers have alleged that the ability of British manufacturers to underquote them arises from labour costs much lower than those which prevail in the United States. If this is the case it would seem that there is little to fear from American competition here, if the prices quoted bear a true relation to their domestic prices. Nor should American manufacturers be able to offer better delivery or maintenance terms. Again, we, too, impose import duties which would add to the price.

American manufacturers consider that they are able to compete, for a few weeks ago three of them asked the C.E.A. if they could submit tenders for plant. Presumably

the Government, accepting the Herbert Committee's recommendation, has agreed that the transformer tenders should be invited and would, in the event of an acceptance, be prepared to grant the necessary licences. It should be certain, however, that tenders were on an equitable basis and that their acceptance (probably on a dollar basis) would really be in the national interest.

THE OTHER SIDE

When considering such matters as are dealt with in the foregoing leading article it is as well to look at the other side of the shield. Manufacturers in the United States recently asked their Government to reject foreign tenders for water turbines because they were based on what the manufacturers considered to be unfair conditions. Earlier, an English Electric bid for the supply of turbines for one of the dams on the Columbia River was passed over in favour of a higher offer by Allis Chalmers, the American firm. Now the decision has been reversed, in the face of a threat of legal action by an American taxpayer, in order to avoid delay.

Another relevant point is that Lord Citrine a month or two ago said that the Central Electricity Authority knew that British electrical manufacturers had asked Electricité de France for an opportunity of tendering for some of that organisation's requirements. He said that Electricité de France had expressed the view that it would consider British offers if French manufacturers were allowed to tender for C.E.A. requirements. The British Government was ready to approve this policy, but said that there were import licences to be negotiated and the particular question could only be determined on the application for a licence.

HISTORIC OCCASION

Another milestone on the road to atomic power was reached on Monday when the tenders for the first of the C.E.A.'s nuclear generating stations were opened. These have been put in by the four industrial groups formed for the design and construction of the new stations headed by Associated Electrical Industries, Ltd., the English Electric Co., Ltd., the General Electric Co., Ltd., and C. A. Parsons & Co. Ltd.

Little has been revealed about these tenders. We are assured that they have been prepared entirely independently (and at great cost), although, of course, the groups have had to maintain contact with the Atomic Energy Authority from whom the uranium "fuel" will be obtained. It is known, however, that the output of the new stations will be from two to three times that originally envisaged because the main consideration will be the production of power, not plutonium (as at Calder Hall), and it is certain that the heat extraction and steam raising arrangements have been greatly improved.

We have been told that the first charge of uranium will be included in the capital cost. This and the subsequent replenishment of the reactor elements are the principal unknown cost components. Whatever basis has been assumed, it has been confidently stated that the cost of the power produced will be comparable with that of coal-generated electricity, with a good prospect of reduction in the future.

PERTINENT POINTS

Sir Harry Railing's remarks at the annual meetings of the General Electric Co., Ltd., are always a great deal more than a review of the activities of the company and its associated companies, and as the head of one of the largest manufacturing concerns in this country, whose interests are world-wide, his authoritative observations command attention. At last week's annual meeting he referred to some of the factors which influence our national economy. He indicated that despite our programme of power station construction, we were lagging behind Germany and the United States in electricity production, and that (as he has many times stated) our programme should be at or beyond the rate of 2,000 MW per annum.

Another matter of current importance to which Sir Harry referred was automation, which he maintained was essential if we were to compete with other nations and maintain a reasonable standard of living. On the thorny question of wages he reiterated what he and so many other leaders of industry have constantly emphasised, that higher incomes were only beneficial if they were accompanied by a commensurate increase in output.

ROAD LIGHTING STANDARDISATION

At the recent conference at Blackpool of the Association of Public Lighting Engineers there was a great deal of "out-of-session" talk about pleas for uniformity of public lighting and we heard some warm expressions of opinion that sharp changes in lighting types and intensities were irksome to motorists and likely to increase road accidents. No doubt much of this discussion was inspired by Mr. Carpenter's presidential address in which the questions of both lighting uniformity and road accidents were dealt with forcefully, and in particular by the president's assertion that general uniformity of public lighting would lead to restraint on valuable new developments and the discouragement of flexibility of design.

We agree with Mr. Carpenter that public lighting should be planned to suit the community, the locality, and the particular application, and it is important that lighting specialists should have freedom of choice in providing the best solution. Mr. Carpenter's view was that "the class and intensity of lighting should be of a similar standard and frequent changes of colour avoided on through traffic routes, but it would be most unwise to impose general uniformity."

CALDER HALL

Her Majesty the Queen is to inaugurate the Calder Hall nuclear power station, the first of its kind in the world, on 17th October. The *Electrical Review* of 19th October will contain a special section in which the Calder Hall reactors, steam plant and generators will be fully illustrated and described in detail. As this issue is likely to be in great demand it is advisable to order it now

Electrical Review 5 *October* 1956

Transformer and Rectifier Production

Expansion and Reorganisation of Hackbridge & Hewittic Factory

A PROGRAMME of considerable expansion and reorganisation has recently been carried out by the Hackbridge & Hewittic Electric Co., Ltd., in its transformer and rectifier works at Walton-on-Thames. In effect, the company celebrates 50 years of progress with the erection of a further extension to the works and installation of a specially designed transformer process oven and associated oil treatment plant. The impulse test laboratory has been increased in capacity and an annealing furnace is being installed for treatment of cold rolled steel.

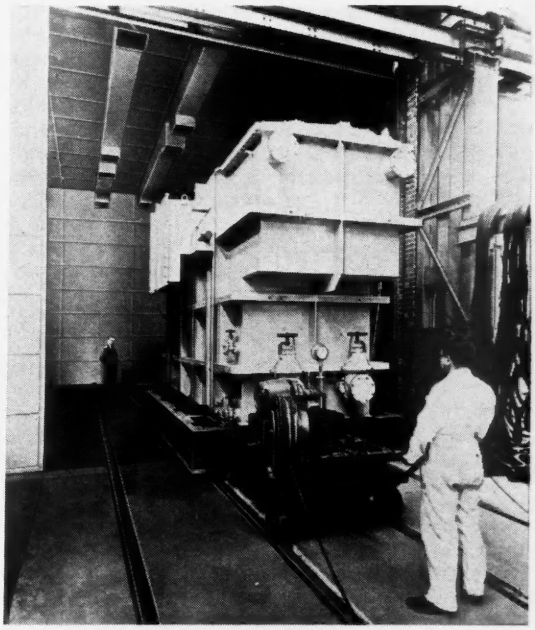
Four major extensions have been made to the works since 1950 with the result that since 1925 the floor area has increased to over four times its original size while the number of employees has increased tenfold. Although to a large extent the extensions have been necessary on account of the large size transformers now called for and the treatment and testing plants necessarily involved in their manufacture, they have permitted a measure of expansion in almost every department.

Particular importance has been attached to the manufacture of very-high-voltage units and a portion of the extended bay No. 3 is devoted exclusively to this work. It has been screened off and the floor painted to ensure cleanliness. Coil winding for these units is carried out in similarly painted and screened coil winding bays, and two 120 MVA 275 kV transformer units are at present in course of production in these departments.

The new extension forming No. 9 bay, now in course of construction, measures 120ft wide by 105ft long and a second floor is provided over half of this area giving a total extra floor space of 18,900 sq ft. This section will be devoted to the winding and erection of rectifier transformers. The works boilers have been converted to oil firing thereby eliminating the dust associated with coal and ash handling. The plant consists of three boilers operating at 100 to 120 lb/sq in and is capable of raising steam at the rate of 40,000 lb/hr.

As transformers must pass an impulse test and withstand such stresses in service it is essential to remove moisture and air from the transformer unit. The oil has to be dried, de-aerated, and filtered to remove all fibrous and suspended foreign matter, so that the maximum possible dielectric strength of the insulation materials may be achieved. For this purpose plant has been installed by the company in collaboration with the General Engineering Co. (Radcliffe), Ltd. It incorporates a drying oven, believed to be the largest in the country, which is capable of accommodating the largest transformers envisaged complete in their own

General view of the oven showing a 45 MVA transformer being removed on one of the hydraulic bogies



tanks. The plant includes de-aeration equipment for treatment of the oil prior to transformer impregation and for subsequent recirculation, also ancillary gear and automatic controls.

Important features of this plant are: it allows complete drying out of core and coil assemblies before impregnation; units can be cooled off in a controlled atmosphere to permit transformer assembly personnel to enter and prepare the transformers for assembly in their tanks thereby reducing to the minimum the time of exposure to shop atmosphere; oil in reservoirs is de-aerated and maintained in a heated condition under vacuum in readiness for use; and ease of transportation of units in and out of the oven.

The equipment has been installed as a self-contained unit in a building flanking the extreme end of No. 3 bay so that it is in close proximity to the heavy erection shop, e.h.v. power test department, impulse test laboratory and dispatch exit. Conveyance therefore from one section to another has been reduced to the minimum and is ideally arranged by co-ordination between the heavy overhead crane and two hydraulically propelled bogies which run on flush-mounted floor rails in a crosswise direction between the oven and impulse test laboratory. With this system transformers for treatment are placed on the bogies and run into the oven, thence to the impulse test laboratory and back to the crane position for preparation for dispatch and loading on to the transport vehicle alongside.

When a transformer core and coils assembly is taken into the drying oven, air heated by means of external steam/air heat exchangers is circulated through the system of ducts and the temperature in the oven raised to 105 deg C. The steam heating is automatically supervised to control the speed of evaporation and avoid deleterious effects on insulation, and the oxidation of metal parts. To prevent a progressive rise of relative humidity a proportion of the moisture laden air is allowed to escape to atmosphere, and is replaced by an equivalent intake through filters from the factory. After about 24 hours the bulk of the moisture content will have been dissipated and the next stage of drying should commence.

During this next stage the relative humidity of the oven is gradually reduced to a very low dewpoint and this is maintained continuously by means of two absorption towers which, by automatic control, operate on a predetermined cycle whereby whilst one is in service the other is being reactivated. The time needed to complete a preliminary treatment has been reduced to about 72 hours, dependent on the volume of the hygroscopic insulating material used in the transformer windings and the prevailing humidity of the factory atmosphere during manufacture.

The core and coil assembly is now cooled off in a controlled atmosphere to permit operators to prepare the unit for placing in its tank, for which purpose it has to be removed from the oven. Thus the time of exposure to shop atmosphere is reduced to the minimum. On assembly in its tank the transformer is returned to the oven, connected to the external process plant by means of flexible hose, and sealed for full vacuum-tightness.

It is then processed by a treatment of vacuum applied alternately with a flow of air within an enclosed system. The air circulating within the transformer is heated and this together with heat derived from the closed air circulating within the oven raises the temperature of the transformer to 70 deg C. To achieve reduction of humidity a dry air stream is injected into the air flow within the tank and a corresponding quantity of air allowed to escape so that the circulating air becomes progressively drier until the required optimum condition of insulation is reached. This process cycle terminates under a vacuum of 0·1 mm absolute and at this stage the necessary quantity of de-aerated oil to ensure impregnation of all the insulating materials is transferred from the storage reservoir to the transformer tank where it is allowed to reach a predetermined level beneath the cover.

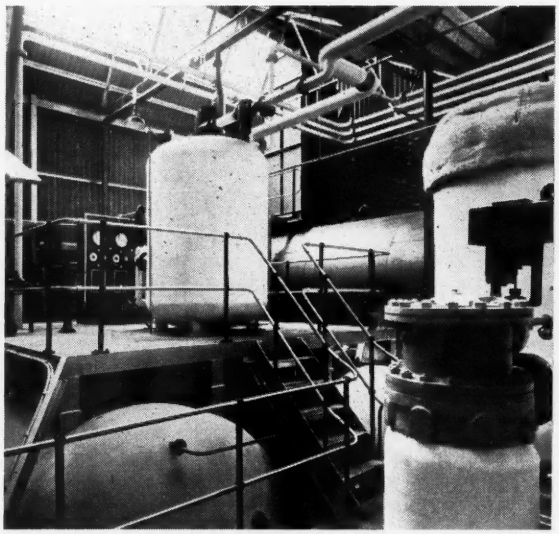
An important characteristic of de-aerated oil is its avidity for air, and this is advantageous at this stage of treatment since it tends to search out any traces of air which may have remained in the insulating materials before impregnation.

The space above oil level in the tank is now returned to atmospheric pressure from a dry air supply and the transformer rapidly cooled, using air circulating facilities within the oven. Internal circulation of oil within the tank as a result of cooling accelerates re-absorption of air into the oil at surface level until it has regained its normal quota, and this procedure ensures that only dry air is re-absorbed. At the conclusion of the cooling period the transformer is withdrawn from the oven for assembly of bushings and other auxiliary fittings.

The last stages of treatment are now performed outside the oven by means of flexible connections to an associated service point. Any moisture which may have been absorbed while bushings, etc., were fitted is eliminated by means of dry air flow at 105 deg C after which the transformer is connected to the treated oil reservoir and the oil raised under vacuum to the correct level. Finally, the oil is pumped round a circuit comprising the transformer (now under the pressure of a head of oil), the filtration plant, calorifier, and de-aerator until it has regained its original degassed state, and the mature electrical strength of the insulating materials is obtained. At the same time any fibrous material from the core and windings which may have become suspended in the oil following impregnation will have been removed.

Surge Generator Equipment

The surge generator equipment has been transferred to more spacious quarters in the extended No. 5 bay. Its capacity has been increased to over two million volts for impulse tests on transformers up to the 400 kV system voltage class. The generator embodies twelve stages each consisting of an oil-filled capacitor with the usual front, tail and charging resistors and adjustable gaps. The twelve gaps are adjusted simultaneously by a small geared-

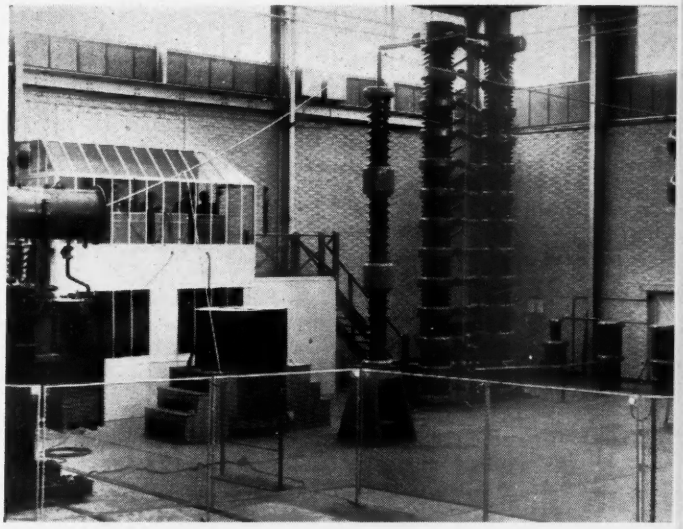


Oil storage and treatment plant showing centralised electrical controls, de-aerator and filter presses

down electric motor which is operated from the control desk. The gap spacing control is calibrated directly in kilovolts, and adjustments can be made while the capacitors are being charged up.

Facilities are included for the rapid developing and examination of oscillograms while a series of tests is being carried out. A recurrent surge oscillograph which enables the surge distribution and other data of the windings to be ascertained has been produced by the company's research laboratories. This apparatus gives a valuable prediction of the impulse distribution and assists in locating any weakness which might be prejudicial to the success of the test.

A considerable proportion of the company's output of transformers consists of units in which cold rolled steel is used for the core. Experience has shown that the ideal performance of the steel can be achieved only after " work stresses " produced in its grain structure during fabrication of the laminations have been relieved. To meet this requirement an " EFCO " annealing furnace is being installed in No. 3 bay. This electric furnace will permit the stress relieving of 20 tons of steel per week at a maximum temperature of 850 deg C in a controlled atmosphere of nitrogen.



General view of the impulse test laboratory

Transformer Construction

Transformer design and construction have been kept in line with modern trends and the latest insulation materials and methods of clamping windings introduced. Much new winding machinery has been installed, many of the larger units being of the company's own manufacture.

Cores are built from high-grade silicon steel laminations cut from either hot rolled sheet or, when specified, from cold reduced anisotropic material. Special cradles are employed in the building of the larger cores to obviate straining of the laminations when lifting the cores into the vertical position. Each winding is rigidly braced radially from the core by core packing strips and the successive strips forming the vertical oil ducts. The pressboard spacers forming the horizontal oil ducts and the end insulation are treated before use to prevent shrinkage and by careful proportioning of the conductor insulation an equal amount of ultimate shrinkage in each winding is obtained. Axial clamping pressure is exerted evenly by means of top core clamping frames pulling down on to a common mild steel end ring, which in turn clamps the windings between the ring and the bottom frames. Thus, after final vacuum drying in the factory, no movement of the windings in any direction is possible in service. The entire mechanical support of the windings is designed to withstand the electromagnetic forces resulting from the peak asymmetric short-circuit currents that occur when the only limiting impedance is that inherent in the transformer itself.

The entire dielectric circuit is designed so that an adequate ratio of stress to strength is maintained in all parts for both power frequency and impulse voltage stressing. Stress control, in the form of electrostatic shielding, is employed when necessary and all major insulation to earth includes the requisite amount of solid insulation positioned normal to the electrostatic field, thus obviating the weaknesses and inefficiencies of long unbroken surface paths. Every transformer is designed to meet its appropriate impulse test level, whether or not the customer has called for this test to be applied.

Rectifier Manufacture

Concerning rectifiers, the extensions have permitted the opening of a complete new assembly bay for large power rectifiers, and re-arrangement of the medium and low power sections. The rectifiers are constructed on a unit basis and modern production methods have been introduced to speed up assembly and dispatch. At the same time advances have been made in cubicle design which not only assist in production but are of considerable advantage in installation and at the same time afford an exceptionally neat and modern appearance.

Conservative Party Conference

AMONG the resolutions in the agenda for the forthcoming annual conference of the National Union of Conservative and Unionist Associations (Llandudno, 10th to 13th October) are several relating to the nationalised industries. Most of them are critical and call for closer control of the Boards' activities. One, from Durham, urges the Government to " formulate and determine a national policy for domestic heating in relation to solid fuel, gas and electricity, thus eliminating the waste of public money occasioned by competitive advertising and services."

On behalf of the Cardiganshire Association the Conference is to be asked to " view with concern and disapproval the vast sums of money spent by the British (*sic*) Electricity Authority in the erection of magnificent showrooms and in advertising, the purpose of which is obscure as it is impossible to buy electricity from any other source." The Denbigh Association considers that " Electricity Boards and other nationalised industries should be restrained from furthering the sales of their domestic appliances in deliberate competition with the private traders."

To ensure accountability, the Ealing South Association proposes that " the nationalised industries should be turned into public companies, the Government holding a majority of the shares, the remainder being issued to the public, thus allowing these industries to be run on commercial lines with shareholders having the right to ask questions concerning the chairman's report at the annual general meeting." A motion from the Maldon Association " compliments the Government on the speed at which rural electrification is proceeding, despite the pressure for other capital work."

Other motions in the agenda deal with capital for Colonial development, the " credit squeeze," the need for taxation relief, tax concessions to exporters, automation and trade union practices.

Efficient Use of Fuel

Applications of Electricity in Industry

CONCURRENTLY with the Fuel Efficiency Exhibition described in the *Electrical Review* of 28th September a series of technical meetings took place under the auspices of the Institute of Fuel with Mr. J. N. Waite in the chair. The paper having the most direct electrical bearing was one by Mr. J. I. Bernard (Electrical Development Association) who dealt with the efficient use of electricity in industry. In this he pointed out that this phrase meant in practice avoidance of waste, since there were inherently few losses in application.

Apart from this aspect most scope for improvement lay in lighting. The newest fluorescent lamps gave 57 lumens per watt and colour-corrected mercury-discharge lamps gave 42, compared with 14 to 18 for filament lamps. A more compelling reason for using fluorescent lamps was reduction in glare due to their lower intrinsic brightness, which resulted in increased output by operatives. The level of illumination could be readily checked by a pocket light-meter.

Local lights over machines were not so effective as a higher standard of general lighting, as operatives' eyes could not readily adapt themselves to a strong contrast between the two. Probably the biggest waste (up to 50 per cent) was caused by dirty reflectors. Fluorescent lamps did not get so hot as others and convected air did not deposit so much dirt on their fittings. Measurements in various factories showed increased illumination of from about 70 to 150 per cent after cleaning reflectors.

With modern individual motor drives, starters or "stop" push-buttons should be installed in handy positions for switching off whenever a machine was not in use. A motor should be no larger than required to drive its machine on steady load. Slight upward load variations could be ignored, since British Standard motors would carry 25 per cent overload for ½ hour to 2 hours, depending on their size. Class A winding insulation could safely withstand temperature rises up to 40 deg C.

Advantages of Electric Heating

The chief reason for using electricity as a source of heat was to increase productivity. The advantages were: possibility of precise control of temperature; production of materials of a quality unobtainable by other means; reduction in number of rejects; saving of labour; greater speed of operation; ability to carry out heat treatment, in many cases in the production line, with less handling; absence of products of combustion. Over 90 per cent of the high-grade brass made in Britain was melted electrically. Most steelworks used electric arc furnaces for melting and refining scrap.

An example of the application of electro-magnetic induction was the melting of special steel in a crucible by passing an alternating current through a coil surrounding it. Induction heating was also used for heat treatment; by increasing the frequency up to hundreds of kc/s; the skin only of the metal was heated, giving it a hard surface but a tough core.

Radio frequencies were used for the heating of wood and other poor conductors of heat by placing them between plates charged to a very high voltage so that their whole thickness was heated simultaneously by the capacity current (dielectric heating). Other methods depended on infra-red lamps or on high-temperature sheathed-wire elements in reflectors which focused a large proportion of the radiant heat upon the goods, as in the quick drying of painted surfaces. Electric resistance furnaces up to 1,200 deg C were made in a large number of types whose special functions were mentioned. The number of electric resistance kilns in the potteries was now over 150.

The construction of automobile bodies in thin gauge metal had been made possible only by electric welding machines, some of which could make 250 welds simultaneously. For testing and inspection, electrical methods, being non-destructive, could be applied quickly to a whole production instead of to a few possibly non-representative samples. Among electronic tools the photo-electric cell could be used for an inspection range extending from counting objects passing on a conveyor to detecting pinholes down to 0·001in diameter in tin-plate strip travelling at 600ft a minute.

Iron and Steel Research

THE 1956 issue of "B.I.S.R.A. Survey" (British Iron and Steel Research Association) is designed to mark the completion of the first ten years of B.I.S.R.A.'s operative existence, and reviews the achievements and progress of each of B.I.S.R.A.'s five Divisions. An article on the application of remote position control to rolling mill plant draws attention to recent advances in this field. Position control not only simplifies the work of the operator, but positioning becomes much faster and more accurate—a matter of considerable potential importance to the iron and steel industry where so many thousands of auxiliary motor drives are employed.

Greater yield from ingots is foreshadowed by two other projects described. Advances in hot-topping technique, particularly the introduction of exothermic mouldable materials for the headbox lining, have proved very successful in reducing the discard. A study of various types of mould dressing has yielded much information on desirable characteristics and the relationship between the type of dressing and different pouring practices.

Improvements in the method of applying tin coatings to steel strip, providing a better bond and more accurate control of the thickness of the coating, are also described, and attention is drawn to the development of improved methods of analysis. Reference is also made to the current work on the important problem of combined creep and fatigue.

B.I.S.R.A.'s plans to install an electronic computer at the Battersea laboratories are announced. Its application to conditions within the steel industry and the most effective methods of employment will be progressively studied. Attention is drawn to the facilities available, under certain circumstances, by which member firms of the Association can commission individual research inquiries. While such commissions can only be accepted subject to the exigencies of the B.I.S.R.A. basic research programme, they provide an opportunity, especially for the smaller firms with limited research facilities, to apply to their individual problems the wide experience of an organisation specifically designed for research.

Heating-Element Materials

Relationship Between Specific Resistance and Temperature

BY T. A. DUNTON, B.Sc., A.Inst.P., and H. LEWIS, B.Sc.*

THE materials most commonly used for the heating elements in both domestic and industrial electric heating appliances are nickel-chromium and nickel-chromium-iron alloys. These combine the necessary high degree of oxidation resistance with suitable electrical properties.

A nickel-chromium alloy containing 20 per cent chromium, and a nickel-chromium-iron alloy containing 24 per cent iron and 16 per cent chromium have become widely accepted as standard materials, the former as a high-quality alloy for use in exacting conditions, involving service temperatures up to about 1,150 deg C, the latter as a lower grade material, satisfactory for less severe applications at temperatures below about 950 deg C. Minor amounts of other elements are alway present, often deliberately added to improve the resistance of the alloys to oxidation.

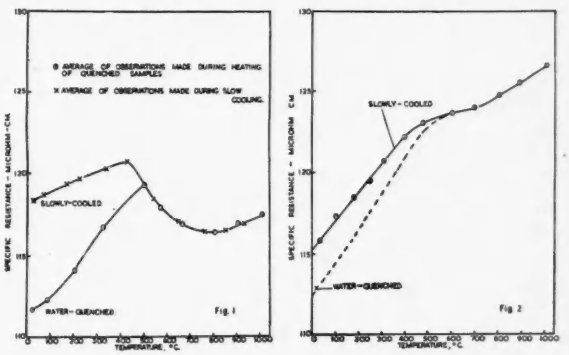
It is customary for manufacturers of these alloys to supply material which conforms to a guaranteed specific resistance within tolerances of ±5 per cent. In addition, wire, tape, etc., are supplied to a given resistance per unit length, calculated from this guaranteed specific resistance; the tolerances are ±5 per cent in all but very small sizes, for which the permissible variations are somewhat greater. These tolerances are set out in B.S. 115. The electrical resistance of the elements at the operating temperatures of heating appliances is also of obvious importance for design purposes. The relationship between specific resistance and temperature of these alloys is complex, because of a structural change which occurs in the alloys during heating and cooling. This change is of the same nature as that undergone by an alloy having the stoichiometric proportions of three atoms of nickel to one atom of chromium, which has been fully investigated by Taylor and Hinton.[1] At high temperatures the structure is "disordered," i.e. the atoms of chromium are randomly distributed with respect to the nickel atoms in the regular crystallographic arrangement of atoms on a face-centred-cubic lattice. On the other hand, the alloy is capable, at low temperatures, of assuming an "ordered" structure, where the chromium atoms are spaced not randomly but in regular arrangement at certain positions on the main face-centred-cubic lattice.

Order-Disorder Reaction

The specific resistance of the ordered Ni_3Cr is slightly more than that of the disordered alloy, and the specific resistance of an alloy of this type at room temperature depends upon the degree of ordering achieved, which in turn is controlled by the rate at which the alloy has been cooled from temperatures above 500 deg C.

The purpose of this article is to describe the extent to which this phenomenon is demonstrated in the alloys "Brightray C" and "Brightray B," as supplied by the authors' company. The former is a nickel-chromium alloy and the latter a nickel-chromium-iron alloy; both are widely used in the construction of electrical-resistance heating equipment.

In order to illustrate the possible extent of the effect of the order-disorder reaction upon the specific resistance



Left: Fig. 1.—Specific resistance/temperature curves representative of slowly cooled and rapidly cooled "Brightray C" and (right) Fig. 2.—Specific resistance/temperature curve representative of "Brightray B"

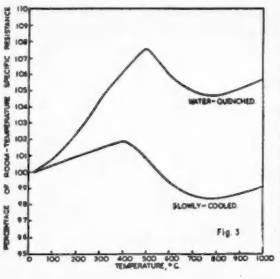
of these alloys, the specific resistance/temperature relationship was studied for slowly cooled and rapidly cooled samples. Measurements representing the slowly cooled condition were made during cooling from 1,000 deg C over a period of four days. Samples of the same alloys were also water-quenched from 900 deg C and temperature/resistance values representing the rapidly cooled condition were obtained during reheating of these quenched samples.

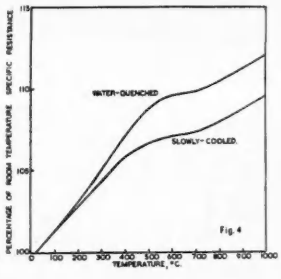
The average results for a number of heats of "Brightray C," having an average chromium content of 20·4 per cent, are shown in Fig. 1. The two curves illustrate the extremes between which the resistance may vary at temperatures below 500 deg C. Above 500 deg C the two curves coincide. The difference in resistance is greatest at, or just above, room temperature. In the slowly cooled condition the room temperature specific resistance was 118·4 microhm-cm, and in the water-quenched condition it was 111·7 microhm-cm. The form of the resistance/temperature relationship for slowly cooled material indicates a decrease of resistance with falling temperature, except in the range 800 deg C to 500 deg C, where ordering is occurring during cooling and resistance therefore increases.

In the water-quenched material this ordering reaction had been suppressed by rapid cooling through the transition-temperature range, but it took place to some extent on subsequent reheating, with the result that the change of resistance with temperature, below about 500 deg C, was greater than that shown by the curve for material in the slowly cooled condition. Further heating to about 800 deg C then disordered the alloy again, with consequent reduction of specific resistance.

Fig. 2 shows the corresponding curves for "Brightray B," as determined on wire from heats having average contents of 16·7 per cent chromium and 23·9 per cent iron. In this alloy there is only a relatively small difference between the water-quenched and the slowly cooled materials, consistent with the fact that, by virtue of its lower chromium content and the addition of iron, its composition is further

* Both of the Mond Nickel Co., Ltd., Birmingham.





Left: Fig. 3.—Variation of specific resistance with temperature of water-quenched and slowly cooled " Brightray C " and (right) Fig. 4.—Variation of specific resistance with temperature of water-quenched and slowly cooled " Brightray B "

from the stoichiometric proportions of elements from which a fully ordered structure can be obtained. The room temperature extremes of specific resistance were 115·5 microhm-cm in the slowly cooled condition and 112·8 microhm-cm in the water-quenched condition. The smaller change in resistance due to ordering, as compared with " Brightray C," is superimposed on a steeper curve, with the result that, in the region of the order-disorder transformation, the curve shows only an inflection and not an increase of resistance with falling temperature.

Because of unavoidable heat-to-heat variations in composition, there may be slight variations from the actual values shown in Figs. 1 and 2. It is, therefore, preferable for some purposes to express the resistance as a percentage of the room temperature resistance, as shown in Fig. 3 for " Brightray C " and in Fig. 4 for " Brightray B." The specific resistance at elevated temperatures of particular samples of these alloys can then be calculated from a knowledge of the specific resistance at room temperature.

Tests after Annealing

These two alloys are normally supplied in one of two annealed conditions, viz. " bright-annealed " in an atmosphere which prevents oxidation or " oxy-annealed," i.e. annealed in air to produce an oxidised finish. The rate of cooling after these annealing treatments does not correspond to either of the extremes investigated above. Tests were, therefore, made on wires of various sizes obtained from normal production in each of the two annealed conditions. The specific resistance of these samples was determined by a method substantially conforming to A.S.T.M. Specification B63-49. The results are shown in the table.

As would be expected from the more rapid cooling rate employed after the modern " strand-annealing " process of bright annealing, the bright-annealed samples generally gave values lower than the corresponding oxy-annealed samples. The value for the particular sample of bright-annealed 25 s.w.g. wire used is actually below the minimum of the range represented in Fig. 1, whilst that for the 10 s.w.g. sample is just at the lower limit. These lower-than-average values can be explained by the fact that the chromium contents of these samples were lower than the average of 20·4 per cent of the heats from which the data in Fig. 1 were compiled.

The specific resistance values for " Brightray B " mill products, also given in the table, show that again the bright-annealed samples were generally of slightly lower specific resistance than the oxy-annealed specimens. The values obtained for the thinnest wire were within the extremes produced by water-quenching and slow cooling, as indicated in Fig. 2: the thicker wires gave values lower than the extreme indicated for water-quenched material. Again, this effect is explicable in terms of composition, since these heats have lower chromium contents than the average value of 16·7 per cent of those from which the values in Fig. 2 were taken. Other experience suggests a correction of 2 microhm-cm increase in resistance to compensate for each 1 per cent increase in chromium content. Application of such correction to these results would generally bring the values within the indicated range.

The average value of the specific resistance of " Brightray C " samples was 111·6 microhm-cm in the bright-annealed condition and 114·5 microhm-cm in the oxy-annealed condition, and average specific resistances of bright-annealed and oxy-annealed " Brightray B " were, respectively, 111·2 and 112·8 microhm-cm.

Thus, if, as is common practice, a single value is quoted as representative of the specific resistance of each alloy, a value of 113 microhm-cm is typical of " Brightray C," and a value of 112 microhm-cm is typical of " Brightray B." These typical figures, particularly for " Brightray C," will tend to be slightly low for oxy-annealed wire and rather high for bright-annealed wire.

Hodges[2] has drawn attention to the fact that published values of the specific resistance of some commercial nickel-chromium alloys require adjustment because of the slight modifications in composition which have been made to improve oxidation resistance. Such improvements are incorporated in " Brightray C," and for this reason the value of 113 microhm-cm for this alloy is actually higher than the value of about 109 microhm-cm frequently quoted as typical of the 80-20 nickel-chromium alloy.

On the other hand, the value of 112 microhm-cm given as typical of " Brightray B " is in reasonable agreement with published values for the 16 per cent chromium, 24 per cent iron alloy which range from 110 to 112·5 microhm-cm.

For precision applications of nickel-chromium and nickel-chromium-iron alloys and when they are used as highly accurate resistance materials at temperatures below 500 deg C, the effects of the order-disorder reaction on resistance must be taken into consideration. However, the sensitivity of the specific resistance of these heat-resisting alloys to cooling rate need occasion no alarm on the part of manufacturers of heating appliances. The variations possible are too small to affect efficient working in most designs of heating element and, furthermore, operating temperatures are usually above the range in which variations of resistance at a given temperature can occur. Thus, for the normal range of applications of these alloys as resistance heating elements an appreciation of the changes due to the order-disorder reaction is desirable only

SPECIFIC RESISTANCE, AT ROOM TEMPERATURE, OF " BRIGHTRAY C " AND " BRIGHTRAY B " WIRES IN VARIOUS GAUGES

Batch Number	Finish	Thickness s.w.g.	Composition Fe %	Cr %	Ni %	Specific Resistance microhm-cm
Brightray C—						
1	Bright	10	0·25	20	Substantially balance	111·7
	Oxidised	10				113·9
2	Bright	25				109·0
	Oxidised	25				113·2
3	Bright	40				114·0
	Oxidised	40				116·3
Brightray B—						
1	Bright	10	24	16	Substantially balance	111·0
	Oxidised	10				112·6
2	Bright	25				108·5
	Oxidised	25				110·4
3	Bright	40				114·1
	Oxidised	40				113·5

in order that the limitations of routine "cold-resistance" measurements may be fully understood.

The rate of cooling for a given component will be approximately the same after each period of service and the "cold resistance" will return to a constant value typical of the apparatus. For many appliances, such as domestic fires, toasters, irons, etc., it is probable that, whatever the finished condition in which the wire or tape is originally employed, the normal rate of cooling, on switching off, will give rise, after service, to a specific resistance in the element material approximately similar to that of oxy-annealed wire. Slower rates of cooling and higher specific resistance when cold will be typical of installations such as heat-treatment furnaces, which have large heat capacity. Rates of cooling sufficiently fast to correspond to the bright-annealed condition are likely to arise only in an apparatus of small heat capacity, employing very thin wires.

The authors' thanks are due to the Mond Nickel Co., Ltd., for permission to publish this article.

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[1] Taylor, A., and Hinton, K. G. "A Study of Order-Disorder and Precipitation Phenomena in Nickel-Chromium Alloys." *Jnl. Inst. Metals*, 1952–53, LXXXI, 169–180.
[2] Hodges, H. "Domestic Heating Elements." *Electrical Review*, 1953, CLIII, 607–612.

Thermal or Hydro?

Plans for Meeting India's Future Power Requirements

By Our Indian Correspondent

AFTER a detailed survey lasting over two years, the Central Water and Power Commission has announced that the total hydro-electric potential of India is of the order of 35 million kW. The west-flowing rivers of the peninsula have a potential of 3·7 million kW, the east-flowing rivers 6·8 million kW, rivers in the central region 3·9 million kW, and the Himalayan rivers between them about 20 million kW. These estimates have been worked out from a detailed study of available maps; a 60 per cent load factor has been assumed for power stations that can theoretically be set up at various points. It is interesting to recall that an earlier survey carried out in 1920 gave the total potential as 10 million kW.

At the beginning of 1956 the installed capacity of water power plant stood at 860,000 kW, that is, roughly 2·5 per cent of the total potential. The output of hydro-electric plant during 1955 was 3,667 million kWh, 43·3 per cent of the aggregate output of 8,468 million kWh in that year. The percentage of generation by hydro-electric plant has been rising steadily during the last few years and is expected to increase further in the next five-year period, when an additional capacity of 2·1 million kW is to be commissioned as against only 1 million kW of thermal plant. Between 1951 and 1961 the installed hydro-electric capacity is expected to show a five-fold increase, from 0·56 million to 3·06 million kW, while thermal plant capacity will be increased from 1 million to 2·55 million kW. This rapid rise of hydro-electric over thermal power is mainly due to the fact that, in a period of acute food shortage, special consideration has had to be given to multi-purpose river development wherever possible, and hydro-power is merely a by-product of irrigation and flood control schemes. As long as this scarcity continues, river development including hydro-power will have priority over purely power projects, despite the fact that the capital investment necessary for water power is often two or three times that needed for thermal plants.

Estimated costs of some recent major projects are given in the accompanying table. It will be seen that the capital cost per kilowatt of installed capacity does not exceed Rs.2,000* and is on the average about Rs.1,200. The capital cost for thermal stations is also of the order of Rs.1,200 per kW, and rarely exceeds Rs.1,400. But there is a major difference in the evaluation of these costs. Since the generation of electricity is only a part of a multi-purpose project, and since a substantial part of the cost of the project as a whole, including the construction of storage reservoirs, is charged to irrigation, the total capital expenditure involved on any project is considerably higher than the figures given in the table would indicate. To give one instance, the Hirakud project on the Mahanadi River in Orissa will supply about 200,000 kW at a total cost, including the dam but excluding irrigation canals, of not less than Rs.50 crores.* This gives the unit capital cost as roughly Rs.2,500, more than double that for thermal power. It is, therefore, quite possible that the Government will be led to think more and more in terms of thermal power in the future, once the food situation is under control.

The time factor is another point in question. In many regions and industrial centres of India, such as Ahmedabad and Madras, it has been found expedient to generate electricity in thermal stations despite the fact that coal for these stations has to be hauled for several hundred miles, and there is hydro-electric potential available in the neighbourhood. In the city of Bombay the shortage of power is so acute that a thermal power station of 100,000 kW capacity at a cost of about Rs.12 crores has had to be set up despite the fact that power from the Koyna project (hydro) will be available in about five to seven years' time. The thermal *v.* hydro controversy appears to be veering in favour of coal after the announcement of the Commission that the entire hydro potential would be exhausted within about 25 years, if the present rate of expansion were maintained during that period. India's coal reserves, on the other hand, are estimated at 40,000 million tons and her present annual consumption is less than 50 million tons.

ESTIMATED COSTS OF SOME RECENT MAJOR PROJECTS IN INDIA

Scheme	Proposed installed capacity, kW	Estimated cost, million rupees	Cost per kW installed, Rs	Cost per kWh, annas
1. Koyna, Bombay (first stage)	240,000	266·70	1,110	0·25
2. Bhakra-Nangal, Punjab (four units)	316,000	219·20	694	0·19
3. Rihand, U.P.	160,000	202·60	1,267	0·21
4. Pamba, Travancore-Cochin	240,000	266·70	865	0·17
5. Poringalkuthu, Travancore-Cochin	150,000	140·00	933	0·19
6. Ramganga, U.P.	75,000	108·70	1,449	0·24
7. Bokaro, D.V.C. (thermal)	50,000	35·00	700	
8. Korba, M.P. (thermal) ...	90,000	85·40	949	
9. Katni, M.P. (thermal) ...	20,000	27·00	1,350	
10. Hirakud, Orissa (second power house)	72,000	89·00	1,236	

* 1 rupee = 1s 6d; Rs. 1 crore (ten million) = £750,000.
1 anna = 1·125d; 16 annas = 1 rupee.

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Basic Lighting Terms

DR. WALSH is, naturally, academically correct in the points he makes regarding the definition of the foot-lambert in his letter of 28th September.

It is not difficult—in fact I will go so far as to say it is mechanically easy—to give precise definitions of terms, but it is very much more difficult to express a definition in such a way that it can be easily understood by the sort of people for whom my article was written, such as, for example, electrical contractors and works engineers.

In writing for, or talking to, non-specialists on any specialised subject I consider there is every justification for simplifying a term so that it can be understood. Although such a statement may not be academically precise it is justified provided it does not mislead, and I do not consider that my statement on the foot-lambert is in any way misleading.

If one takes the easy course and writes academically it is very unlikely that the person for whom the information is intended will bother to get past the first few paragraphs.

I appreciate and respect Dr. Walsh's desire to uphold the sanctity of truth in print in general and in technical print in particular. It is, however, my belief that truth and simplification can walk hand in hand, although the path is indeed a difficult one.

E. HARRISON-JONES.

[Dr. Walsh also drew attention to the use of "1" instead of "lm" as the symbol for lumen. The lapse was ours, not Mr. Harrison-Jones's. In extenuation we may perhaps plead that although "lm" is given in B.S. 1991 variations are very common. In one of this year's A.P.L.E. conference papers "L/W" was used for luminous efficiency and we have even seen "L.P.W." used in a lampmakers' catalogue.—*Editors.*]

Clearer Catalogues

MR. DONNACHIE, in the *Electrical Review* of 21st September, puts forward his view that the provision of information by manufacturers of public lighting equipment is in no wise as haphazard as stated in my article. I am afraid, however, that I am unrepentant, since my views were those engendered by a review of the various products which I carried out. Obviously there are many manufacturers whose information service is more than adequate, but at the same time there are those whose arrangements for the provision of information are confusing to say the least. Mr. Donnachie has classified my complaints under three headings, and my comments to these are as follows:—

(*a*) *Introduction of new designs.*—Mr. Donnachie agrees with me that the Public Lighting Conference is the time when new equipment is generally introduced, but I adhere to my view that technical information should be available at the time of the Exhibition. It may interest him to know that I was unable to obtain such information at this year's Conference at Blackpool in the case of two of our most prominent manufacturers. It may not be so after this year's Exhibition, but I can assure him that other years follow-up particulars regarding new products have not been forthcoming.

(*b*) *Discontinued lines.*—Manufacturers are, of course, aware of the lines which are needed to meet requirements adequately, and whilst I do not think I should fall into the error of selecting an equipment which is discontinued because it is no longer suitable, this is not the case with many of our smaller lighting authorities. In support of this I would say that I am aware of requests for the supply of the simple enamelled dispersive reflector which died a natural death many years ago. After all, if one of the leading manufacturers takes the trouble to inform one of discontinued lines there is no reason why others should not do the same.

(*c*) *Catalogues.*—I still adhere to my view that much is to be desired in the way of clarity. Might I suggest that Mr. Donnachie compiles a list of each separate item, together with its variations, for ready reference. He will then find, as I did, the difficulties that beset one in making an ordered list. I am still of the opinion that manufacturers have much to learn in the compiling of catalogues, a view substantiated by comments made to me at Blackpool.

I have no criticism to offer regarding the provision of information when an approach is made to a representative, but it is my contention that information should be readily and clearly available without recourse to such an action. As I stated at the beginning of this letter, many of our manufacturers are, like Cæsar's wife, above suspicion, but there is, alas, the minority.

Pentyrch, Glam. F. H. PULVERMACHER.

Guide to Wiring Regulations

AS in the case of the 12th edition of the I.E.E. Regulations for the Electrical Equipment of Buildings, the Association of Supervising Electrical Engineers has issued a guide to the requirements of the 13th edition (1955), with permission from the Institution. It is intended for supervisors and operatives who have to apply the Regulations and the arrangement and wording follow generally those of the official document, except where varied for simplification or for explanatory purposes. All such variations (for which the A.S.E.E. is responsible) are printed in the Guide in heavier type and attention is drawn to important points by underlining.

Clarifying notes are numerous and practical and are in many cases aided by useful diagrams, which include several relating to starters for which acknowledgment is paid to Allen West & Co., Ltd., and the Electrical Apparatus Co., Ltd. As the current edition of the I.E.E. Regulations differs substantially in arrangement from its predecessor, apart from its provisions for improved techniques and materials, the Guide contains a cross-reference index between the two where applicable.

The Guide, which is obtainable from the Association at 23, Bloomsbury Square, London, W.C.1, is priced at 7s 6d for cloth-bound and 5s for limp-bound copies, with special terms for students.

Lancashire Dynamo Developments

The Lancashire Dynamo Nevelin works at Oxted, Surrey

THE name of Lancashire Dynamo has been well known in the electrical industry for about sixty years, but more recently the development of the Lancashire Dynamo Group of Companies has been extended over a wide range of industrial electrical equipment. The latest stage of this development is announced in the formation of a new company, Lancashire Dynamo Nevelin, Ltd., which has been formed to embrace the activities of the Nevelin Electric Co., Ltd., and Lancashire Dynamo Switchgear, Ltd.

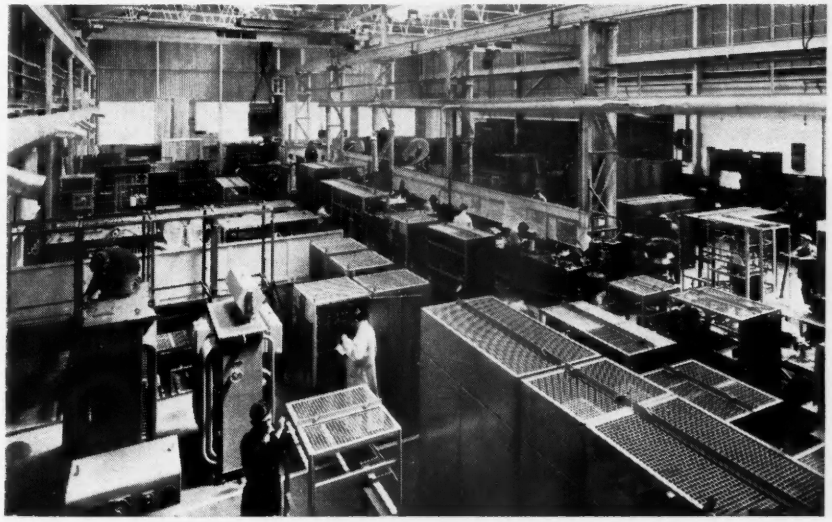
This step follows the decision of the Lancashire Dynamo Group to purchase a new factory on a 30-acre site at Oxted, Surrey, and to carry on there the production of Nevelin rectifiers, previously made at Croydon, and Lancashire Dynamo switchgear, previously manufactured at Bridgwater. These developments have been necessary to cater for the rapidly growing demand for the companies' products, including the Lancashire-Nevelin "Varionic" drive which provides a wide range of adjustable speeds from a.c. supplies. The new company is at present organised in two divisions, one dealing with rectifiers and the other with the whole range of switchgear, but the new Oxted factory will also provide the Group with facilities for further developments as they become necessary.

Mr. A. Newing, M.I.E.E., previously managing director of the Nevelin Electric Co., has been appointed managing director of the new company with Mr. H. W. Bosworth, A.M.I.E.E., as chairman. The other members of the board are Col. P. V. W. Gell, Mr. V. W. M. Press and Mr. W. R. Jones.

The works at Oxted replace a cigarette factory the original buildings of which were thoroughly reconstructed and added to. The various shops are roomy and well laid out. During a brief visit of inspection last week we saw a number of the processes in the production of rectifiers and switchgear, including the manipulation of the glass bulbs and the assembly of equipment.

We were told that the move from Croydon and Bridgwater was accomplished in record time with but slight interruption in output. A large proportion of the 600 or so employees are local people for whom housing accommodation has been provided, largely by the efforts of the company. At the time of our visit rapid progress was being made with the extension of the canteen by employees of the company. Both in space and labour resources there is ample room for expansion of the business at Oxted, which is situated in a healthy and scenic part of Surrey.

Above: Main switchboard assembly shop



Left: Assembly of rectifier cubicles at Oxted

Carpet Fibre Preparation

A NEW central warehouse and blending plant was recently opened by Lord Swinton, thereby marking the first phase in an expansion programme for Petmar Industries, Ltd., which will eventually represent a capital investment of about £1 million. The warehouse is one of the largest buildings of its type in Yorkshire while the blending plant is the only semi-continuous process plant for large scale fibre preparation in Europe. Its output will enable the company to produce 5 million sq yd of carpet a year if necessary.

In the blending plant at the first stage of the production process supplies of wet, freshly dyed fibres are delivered by overhead external conveyors from the dyehouse and deposited on an overhead platform. An automatic conveyor carries the wet fibre into a squeezer which removes most of the free water. After squeezing, the fibre is conveyed to an opening machine where a series of spiked rollers opens up the matted fibres for presentation to the first of two large drying chambers. All machinery handling the fibre up to the point of delivery to the dryers is driven by separate motors equipped with infinitely variable speed gears which enable the pace of each section of the plant to be synchronised and adjusted to the different types of fibre handled.

After passing through the two dryers the fibre is stored in bins from which it is taken and weighed in the correct proportions preparatory to being blended. The final blending operation takes place when the blended fibres are transferred from the mixing and storage bins to underground ducting into a set of centri-blender-hopper-feed-openers and finally into a baling machine. Ultimately the blends will be transferred through outside ducts, boosted at intervals, into bunkers over the carpet production lines, thus eliminating baling and transport.

A feature of electrical interest in the new blending plant is the series of three control panels built by Gent & Co., Ltd., which, between them, control the operation of the entire process. One of these mimic diagram type panels controls the squeezing and drying plant and all the electric motors in this section; the motors can only be started in the correct sequence. The panel also indicates whether the various duct switches are correctly set, thereby providing a foolproof check on whether the flow of material is correctly sequenced to the various machinery and storage bins. This is important as a large variety of colours of fibre is handled in the storage bins and the fibre travelling in the conveyors remains invisible until discharged into the bin. The red light on the panel indicates that a bin is full, the yellow indicates that the doors are open and the bin is being emptied.

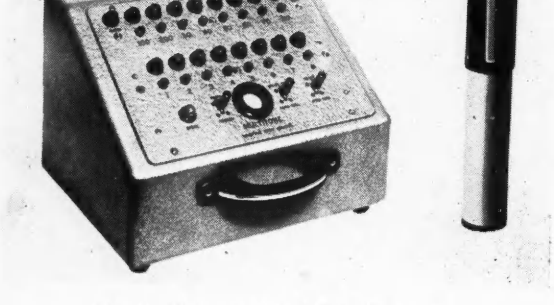
The second panel controls all machinery operating after the fibre has been weighed and has started being made into a blend. This panel also indicates which of the 19 main storage bins is being fed, in just the same way as the first panel does. The third panel controls all motors driving the machinery of the final blending process, and indicates the movement of material from the 19 storage bins to various machines.

Electricity will ultimately be supplied from a new substation, fed from the Yorkshire Electricity Board's network, which is nearing completion on the works site. A ring main is being installed around the site feeding a 600 kVA transformer supplying the blending plant which incorporates 75 motors with a total of 550 h.p. Power supply to the existing plant is provided by a 750 kVA transformer, but this is to be replaced by a 1,000 kVA transformer in the new substation. A further transformer rated at 500 kVA feeds the plastic spreading machines for carpet backing, infra-red curing ovens, and a tufting machine.

Staff Location System

A STAFF location system which has been developed by the Multitone Electric Co., Ltd., in conjunction with St. Thomas's Hospital, operates by means of magnetic induction from audio-frequency currents fed by a transmitter into a loop round the building, and pocket receivers each of which responds to only one of 56 frequencies in the range transmitted.

The receivers are very small and light and clip into the pocket like a fountain pen. They are about 5in long by 1in diameter, weighing about 5 oz with battery, and emit a note of around 1,000 c/s when the appropriate call comes through. They contain four transistors powered by a single Mallory cell. The quiescent current is less than 0·5 mA, giving a cell life of over two months with the receiver permanently switched on.



Coder/oscillator and (right) the pocket receiver

Two versions of the receiver are available, one only gives the warning signal while the other, in addition, receives speech when a button is pressed. The selection of the person being called is extremely simple. Each person on call is assigned a number of one, two or three digits, and to call him it is only necessary to press the buttons corresponding to those digits. The call automatically terminates after one of the three periods which may be selected and all relays are released.

If it is desired to contact more than 56 persons several can share a single frequency and their calls be differentiated by coding. Coding can also be used to convey information. Widely spaced dashes, for instance, may require the recipient to go to the telephone, while closely spaced dashes could make him press the button to receive a message.

In addition to the buttons for call selection two coding buttons and a speech key are provided.

French Railway Electrification

The electrification of the railway between Metz and Luxemburg, using 25 kV a.c. at the industrial frequency of 50 c/s, was inaugurated on 29th September. Only two substations are used to feed the catenaries on this line, one at Luxemburg and the other at Metz.

Trains running between Calais and Bale via Lille will now be hauled electrically between Valenciennes and Metz, marking a further step forward in the realisation of the programme of electrification. It is expected that the line between Metz and Strasbourg will be electrified by January.

World Telecommunications

SIR GORDON RADLEY'S I.E.E. PRESIDENTIAL ADDRESS

WHEN he delivered his inaugural address as President of the Institution of Electrical Engineers in London last evening Sir Gordon Radley chose world telecommunication for his theme but referred first to our own inland system. He said that for this the Post Office had a two-stage plan. The first was to install enough additional plant, chiefly local cables and exchange equipment, to satisfy the outstanding demand for telephone service. The second stage comprised the progressive mechanisation of the system with the introduction of new facilities.

During the past 25 years the results of scientific research had been apparent in building up long distance communication facilities. Cables with 600 speech channels within a single coaxial tube had been installed between the main centres of population. The same line plant, with appropriate repeaters, was used to provide television links. With little modification it could cater for 1,000 telephone channels plus a 405-line television channel on each tube.

Plans for Nation-Wide Dialling System

Large numbers of circuits would be required on main trunk routes to cater for the anticipated growth in traffic when subscribers could dial long-distance calls, a facility which it was planned to introduce in the United Kingdom, beginning probably with calls from Bristol to London and certain other centres in 1959. To make nation-wide dialling by subscribers practicable it was necessary to set up a national numbering scheme; this would enable connection with the wanted telephone to be made by dialling a code to reach the area and exchange of destination, followed by the subscriber's number. The system must be capable of meeting the full requirements of telephone development for many years to come and this had made the Post Office anticipate a system of 20 million subscribers connected to 8,000 exchanges.

Charging for trunk calls was now based on a ticket made out by the operator in respect of each call. This practice could not be maintained if the full advantages of subscriber dialling were to be realised. Automatic message accounting equipment was being used in North America. In this country electronic register translators could be used for the dual purpose of routing the long-distance call and of determining the meter pulsing interval appropriate to the distance.

Electronic Exchanges

Electronic techniques were likely to revolutionise telephone switching within the foreseeable future. In America, the Bell Telephone Laboratories would have a fully-electronic exchange in public service by 1958. Many telecommunication laboratories were pressing on with the development of systems which would render present mechanical equipments obsolescent. Electronic systems fell into two broad types. The first used gas diodes or some other device for interconnecting the speech circuits in a space multiplex; the second, described by T. H. Flowers and his collaborators, used time-division multiplex for interconnecting the speech circuits and control. The production cost of an electronic exchange was likely to be less than that of the corresponding mechanical equipment. Smaller and cheaper buildings would suffice to house the equipment and maintenance costs should be lower.

Referring to the transatlantic telephone cable Sir Gordon said that the completion of the project marked the opening of a new era in the growth of world communication. He thought it would be appropriate, therefore, to review the usefulness to this end of long deep-water cables equipped with repeaters. The development was revolutionary in its possibilities because the capacity of this kind of cable was likely to exceed that required to replace all the existing telephone and telegraph facilities on its route, and the intention of the American Telephone & Telegraph Co. to lay a replica of the transatlantic system from the United States to Hawaii, half-way across the Pacific, in 1957, meant that another big step towards the development of a global network of the new kind had already been taken.

This new development in world communication was of considerable interest to British engineers for many reasons. The United Kingdom not only had a unique tradition in the manufacture of submarine cable, but also a manufacturing capacity which was unmatched in any other country and had been greatly increased and modernised in the last few years. British research on thermionic valves, and British circuit techniques were likely to exert a major influence on submerged repeater practice during the next decade. Furthermore, Cable & Wireless, Ltd., owned 150,000 miles of submarine telegraph cable, more than half the world's total mileage. Communication facilities provided by telegraph cables were limited and expensive compared with what was inherent in a modern cable with repeaters, but the old and new facilities must exist side by side, or in combination, for many years. This would create problems of use in which the Commonwealth Governments would be concerned.

Another Transatlantic Cable?

The impetus given to the growth of communication between Western Europe and North America by the 1956 cable might well call for the laying, at no distant date, of a second cable across the North Atlantic of the greatest capacity technically possible. Eighty circuits in a single cable, or 200 in a twin-cable system, would be an objective only just outside the present limits of repeater spacing and cable diameter. If reasonably loaded with traffic at present call rates, either system would be profitable. The advances that were taking place would make still larger systems possible in a few years' time.

On other world routes the prospects were different. Circuit requirements to Australia and New Zealand were probably not more than 5 to 10 per cent of those to North America. Twenty-four circuits provided over a single-cable system 12,000 miles long would require about 550 repeaters with an even higher standard of fault immunity than that postulated earlier. With costs as high as they would be, cable could not compete with radio for the provision of small groups of circuits for very long distances. Except for the use of relay stations on some radio routes, the cost of terminal transmitters and receivers was about the same for all, and this had set a pattern of uniform charges to most destinations beyond Europe.

The challenge to the communication engineer was to move towards the provision of cable facilities on the main world trunk routes on a scale which had hitherto been regarded appropriate only on land. Sir Gordon said that

he had increasing confidence in the use of electronic equipment in quantity at inaccessible points under the ocean. What was required was a means for laying in deep water the rigid housings for this equipment without the hazards which attended such operations at present.

A repeatered cable from the United Kingdom to Gibraltar would appear to be a useful first step in building up communication facilities on routes other than the North Atlantic. Traffic to the Iberian Peninsula alone might not justify the investment, but the cable would have potentialities for further extension—to West Africa and South America via the Azores.

Modernising Distribution

REVIEW OF PRACTICE IN NORTH WESTERN AREA

As the main theme of his chairman's address to the Institution of Electrical Engineers North Western Centre last Tuesday, Mr. T. E. Daniel reviewed developments since 1948 in the area of the North Western Electricity Board, of which he is chairman. The merging of 76 undertakings in one body entailed the standardising of a multiplicity of electrical systems and voltages and phase relationships in addition to providing for an increase of 82 per cent in kWh sold since vesting day (now 7,346 million kWh/annum) and an expected similar rate of growth in the future.

Many developments have become economically possible through the interconnection of network spurs and through the basing of the grid tariff on the simultaneous maximum demand at all supply points. A summary of the chief technical features introduced to achieve greater economy is given below.

Substation Equipment

Maximum fault levels have been fixed at 750 MVA for 33 kV and 250 MVA for 11 kV. Distribution substations, some outdoor without high-voltage switchgear, are equipped with single 500 or 750 kVA 11 kV transformers and each serves an area not exceeding 20 acres with 0·1 sq in distributors as a maximum. This method makes better use of copper and has reduced capital costs by one-third and improved voltage regulation as compared with the general practice of ten years ago of housing duplicate 1,000 kVA transformers and h.v. switchgear in substantial buildings and of running distributors up to 0·5 sq in to cover up to 140 acres. Sites for 33 kV substations in urban areas are becoming increasingly difficult to find and for 132 kV almost impossible. At 275 kV a substation for 720 MVA of plant with overhead-line entry requires eight acres and unsatisfactory siting can profoundly affect the capital cost of development.

On the 11 kV and 6·6 kV systems in towns the trend is towards open rings or interconnected networks so split as to operate as radial feeders with standby. The saving in capital cost by the omission of protective gear and automatic circuit-breakers justifies taking a slight extra risk of supply failure, but even this risk is doubtful in view of the reliability of modern cables and transformers.

In rural areas, served mostly by overhead lines, closed rings with radial spurs and directional protection with automatic circuit-breakers at a few points only on the ring are generally favoured. Entirely new networks are constructed for little more money than their pre-war counterparts, but a cheaper type of unit is required than the conventional ring-main oil circuit-breaker for connecting a network transformer to the h.v. mains.

Two basic arrangements of 33 kV 750 MVA switchgear are used, viz. the conventional outdoor type in rural areas and the indoor metalclad single-busbar non-phase-segregated type in urban areas. Each of them follows as far as possible a standard drawing, in accordance with a specification, which includes protective schemes and cable boxes into which the cable is laid directly. The single-switch outdoor substation with load-breaking isolators controls two incoming lines and two transformers. The same arrangement is being applied to indoor metalclad gear with nearly a 50 per cent saving in capital cost compared with the conventional switchboard of five oil circuit-breakers.

For 11 kV systems a standard specification has been adopted for single-busbar metalclad gear. This has reduced the number of types of protection available and also the choice of current-transformer ratio from fourteen (under B.S. 81) to a single dual ratio for distribution-transformer circuits and two alternative ratios for feeder circuits. A less costly switch-fuse equipment to control distribution transformers is not yet available.

Transforming points have increased by half since vesting day. To facilitate manufacture 10 MVA (12·5 MVA with forced cooling) transformers were made standard, but in the future 15 MVA (22·5 MVA with forced cooling) will be required, the choice being limited by the current rating of the lower-voltage switchgear. In larger substations the 33 kV switchgear building is sectionalised by fireproof walls on each side of the bus-section switch and the cables are led in through ducts terminating at ground level below the gland of the switch. CO_2 fire-fighting equipment is installed in 33 kV substations but not normally in 11 kV substations, which are laid out on more austere lines.

Cable Standardisation

Cables for 33 kV are standardised at 0·3 sq in. Those on 11 kV and 6·6 kV systems are of 0·06, 0·15 and 0·3 sq in. For medium voltages they are in five sizes ranging from 0·04 to 0·25 sq in. High-voltage cable identification is now given by red p.v.c. tape over the armouring. To meet a need for a cable rated at 30 MVA, the Board is to install 4,000 yd of twin three-core 33 kV gas-filled cables with 0·2 sq in stranded aluminium conductors.

Permission has been given by the Ministry of Fuel and Power for an unearthed construction of overhead lines having conductors up to and including 0·15 sq in. Cross arms of "purple-heart" from Trinidad and Guiana are largely employed. Supplies of this wood are limited, but it is considerably cheaper than steel; it is resistant to creosote impregnation and to fungoidal attacks. The shorter spans and heavier poles required by the larger cross-section of steel-cored aluminium conductors are among the reasons in favour of reversion to copper as soon as price comparisons justify the change in practice.

VIEWS on the NEWS

By REFLECTOR

LONDON'S remaining trolley-buses are now destined for gradual replacement in 1959 according to the latest pronouncement of the London Transport Executive. They are to give way to new oil-engined buses of which 850 have been ordered. In announcing this London Transport again emphasises the greater mobility of motor buses and this time it also quotes medical evidence that the exhausts of these vehicles do not contain any substances injurious to health, if the engines are properly maintained. The statement is based on medical tests with properly maintained and operated engines. Any casual observer in London will not feel convinced that the fumes from diesel buses are entirely harmless; they are, to say the least, unpleasant. Once again I think it a pity that London Transport is not retaining (and maintaining) its trolley-buses, at least in the outer areas, particularly when there is likely to be difficulty in the matter of oil supplies. Other cities in this country and overseas are still operating and extending trolley-bus services satisfactorily.

* * *

Severe criticisms of British industry were made last week by Mr. Francis E. Rogers, head of the United States Technical Assistance Programme in London. He accused British firms of producing inferior goods at excessive prices and said that there was too much complacency and not enough competition. Mr. Rogers also thought that trade union practices must be modified if greater productivity were to be achieved and that there should be closer co-operation between men and management. Only so would Great Britain's position in world trade be strengthened.

Mr. Rogers' " utterly exaggerated " condemnation was swiftly answered by the Federation of British Industries which said that although there were individual cases to support his contentions our export figures proved that we could stand up to competition—even with United States manufacturers and in the United States market. The Federation said that it was stimulating to hear the well-balanced criticisms of our friends but wholesale and undiscriminating strictures lost their force by their very exaggeration. So far as the electrical industry is concerned I, too, deplore Mr. Rogers' outburst. An industry suffering from the alleged shortcomings could never have reached the position in the world's electrical markets which it occupies to-day—and this is not " complacency."

* * *

Mr. L. C. Parker (Haywards Heath) says that he was surprised that I made no mention of the efficiency of Mr. Rostron's thermostatically-controlled gas boiler (*Electrical Review*, 21st September). I didn't mention it because Mr. Rostron failed to give it. Mr. Parker rightly says that the comparison of 1s 4½d/therm for gas against its electrical equivalent of 2s 2·4d/therm is quite misleading unless the appliance efficiency is taken into consideration. He goes on to say that although our competitors, for their own purposes, frequently ignore this, it is most surprising to find me doing the same thing. Once again I must plead not guilty; I was merely quoting Mr. Rostron. From my own experience I can agree with Mr. Parker that

> " with coal at its present price, electricity is now a very real competitor for single room heating, and members of the electrical industry must constantly keep appliance efficiency to the fore as it is an integral part of any calculation in making heat output comparisons."

* * *

I notice in the agenda of next week's annual conference of the National Union of Conservative and Unionist Associations the following motion:—

> " That this Conference compliments the Government on the speed at which rural electrification is proceeding, despite the pressure for other capital work."

In the same agenda there are a number of other motions attacking the nationalised industries (including electricity supply) for their manifold sins and wickedness. And yet the Government is considered to be the benefactor when the electricity supply industry does something which can be approved.

* * *

At the same conference motions are being put forward condemning competition between gas and electricity as unnecessary and wasteful. Yet, I am pleased to note, Mr. David Renton, Parliamentary Secretary to the Ministry of Fuel and Power, expressed the opposite view. He said that the Government was opposed to a fully planned fuel and power policy because it involved compulsion and plans imposed from above were particularly liable to error in conception and operation. The Government wanted the best men it could find to lead the nationalised industries and it would not get them if they were not allowed to get on with their jobs and be responsible for them. A national plan would also weaken competition between the nationalised industries which the Government wished to encourage. Mr. Renton was speaking at last week's North Western Fuel Luncheon Club in Manchester.

* * *

Labour troubles are probably no worse to-day, when there is full employment, than they were half a century ago when employment was precarious. The *Electrical Review* of 5th October, 1906, reported:—

> " There are 7,000 boiler-makers on strike on the Clyde, and 3,000 labourers have been thrown out in consequence. 30,000 miners in the South Wales coalfields have handed in their notices. Engineers at Stockton-on-Tees, Newcastle and Darlington may hand in their notices shortly because the employers have refused to grant an advance of 2s per week on time rates and 5 per cent on piece work. Manchester engineers have made applications for similar advance. The Scottish miners (70,000) have demanded an increase of 12½ per cent in wages. Adding to these the strike of 160 coach-builders at the Brush Co.'s Loughborough works, and bearing in mind also the recent and still expected tramway workers' strikes, as well as the feared trouble among railway workers, there is sufficient cause for disquietude."

PERSONAL AND SOCIAL

Lord Chandos, chairman of Associated Electrical Industries, Ltd., and a director of other companies, is visiting Norway and Sweden on behalf of his industrial interests. He arrived in Oslo on 30th September, and is to have talks with Mr. Lange, the Foreign Minister, Mr. Skauge, Minister of Commerce, and Mr. Sjaastad, Minister of Industries. During his ten-day stay in Norway, Lord Chandos will also meet Dr. Vogt, the director of the Norwegian Hydro-Electric Board, and will have talks with directors of power stations and electricity supply undertakings. Lord Chandos will arrive in Stockholm on 10th October, and there will meet people prominent in the nuclear energy field and members of the State Power Board.

An advertisement appears in this issue inviting applications for the position of director and secretary of the British Electrical Development Association. A commencing salary of not less than £3,250 is offered. **Mr. Victor W. Dale,** the present director and secretary, has intimated his desire to retire at the end of this year.

Holophane, Ltd., has announced changes in its area sales engineering organisation. **Mr. W. H. Dodgson,** who has been lighting sales engineer in Nottingham since 1954, now moves to London where he will represent the company's interests, operating from Westminster. Mr. Dodgson, a registered lighting engineer, has had many years' experience in the electrical industry having held executive posts with the then British Insulated & Helsby Cable Co. and other companies in the North, joining the Metropolitan-Vickers Electrical Co., Ltd., in 1936 as area lighting engineer. He was chairman of the Newcastle Centre of the Illuminating Engineering Society for 1951-52 after serving seven years on the committee; he has now resigned from the I.E.S. Nottingham Centre executive committee on taking up London duties for Holophane.

Mr. E. J. Mara has been appointed sales lighting engineer for the Nottingham area. He served with the R.A.F. and received his training at the Borough Polytechnic. Mr. Mara joined Holophane in 1947 and was an assistant engineer at the company's head office in Westminster before his present appointment.

Mr. W. H. Dodgson

Mr. E. J. Mara

Mr. C. Cameron-Kirby, M.I.C.E., M.I.E.E., M.I.Mech.E., manager, No. 6 (Hull) Sub-Area, Yorkshire Electricity Board, was installed last week for the second year in succession as president of the Hull Association of Engineers.

The Metropolitan-Vickers Electrical Co., Ltd., has appointed **Mr. S. Crosbie,** A.M.I.E.E., M.I.R.S.E., as assistant chief engineer, Railway Signals Department. Mr. Crosbie received his technical education at the Royal Technical College, Salford, and joined M-V in 1919, starting in the traction control drawing office. Later he transferred to traction control engineers, and in 1924 he joined the railway signals section. In 1940 he was appointed engineer-in-charge, railway signals section. Mr. Crosbie has been an evening lecturer in the Electrical Engineering Department at the Royal Technical College, Salford, for thirty years.

Mr. S. Crosbie

Mr. C. F. Huebner, who has been chief buyer for the British Oxygen Co., Ltd., since 1947, has been elected chairman of the Purchasing Officers' Association.

British Railways, North Eastern Region, announces the appointment of **Mr. T. Matthewson-Dick,** A.M.I.Mech.E., A.M.I.E.E., M.I. Loco.E., Assoc.Inst.T., district motive power superintendent, Newcastle-upon-Tyne, as assistant motive power superintendent, York. Mr. Matthewson-Dick joined the London & North Eastern Railway at Newcastle in the Electrical Department in 1923. He has been a lecturer at Rutherford Technical College, Newcastle-upon-Tyne, Constantine Technical College, Middlesbrough, and York Technical College, on mechanical and electrical subjects.

Mr. G. Newman, A.C.I.S., D.P.A., A.M.I.I.A., principal assistant (section head), administration, South Wales Division of the Central Electricity Authority, has been appointed senior assistant secretary of the South Wales Division in succession to **Mr. H. W. Carter,** who was recently appointed divisional secretary. Starting work in the Public Health Department of the Glamorgan County Council in 1937, Mr. Newman was appointed principal assistant (establishments) in the South Wales Division in 1948 and took up his present position three years ago.

Mr. K. H. Hughes, principal assistant (section head), administration, South Wales Division, has been appointed establishments officer of the London Division as from 1st October. Mr. Hughes, who studied law at London University, is a barrister and was for fourteen years assistant in the Town Clerk's Department of Cardiff Corporation. He joined the South Wales Division in 1948.

Mr. M. H. Philips, personnel director to the Heenan group of companies, has been appointed a director of the holding company, Heenan Group, Ltd. **Mr. C. M. A. Whitaker,** assistant general manager of Fielding & Platt, Ltd., one of the associate companies in the group, has been appointed a director of that company.

Mr. B. R. Fletcher, late of J. H. Tucker & Co., Ltd., has recently joined William McGeoch & Co., Ltd., Birmingham, and has been appointed to the Midland area outside sales staff. **Mr. D. G. Ayles,** A.M.I.E.E., manager of the Switchgear Department, has recently been elected president of the Guild of Associates of the Birmingham College of Technology.

Mr. Norman Hoggins has been appointed an additional director of Walsall Conduits, Ltd. He has been employed by the company for eighteen years and for the past four years has been manager of the steel tube mills at West Bromwich. The appointment took effect as from 1st October.

Mr. N. Hoggins

The Commonwealth Relations Office announces that the partner governments of the Commonwealth Telecommunications Board have unanimously appointed **Sir Ben Barnett,** M.C., to be chairman of the Board. Sir Ben retired on 31st July from the post of Deputy Director-General of the G.P.O. which he had held since 1949.

The article on page 599 on "Heating Element Materials" is by two members of the staff of the Mond Nickel Co., Ltd. **Mr. H. Lewis** joined the Development and Research Laboratories of the company in 1937 as an assistant, subsequently becoming a research metallurgist in 1943. Following part-time studies at the Birmingham Technical College, he obtained the London University external B.Sc.

Mr. H. Lewis

Mr. T. A. Dunton

degree in metallurgy in 1943. After a period of work on the development of alloys having specialised magnetic and thermal-expansion properties, he has for about eight years been engaged on problems related to the oxidation and corrosion of nickel alloys at high temperatures and the development of improved heat-resisting alloys.

Mr. T. A. Dunton obtained his B.Sc. degree in physics at Queen Mary College, University of London. He then became a member of the Physics Section, Metallurgy Division, Royal Aircraft Establishment, Farnborough, where he was engaged on the development of non-destructive testing equipment, especially of the eddy-current type. In 1946 he joined the Development and Research Laboratories of the Mond Nickel Co. and has devoted most of his time to the determination and improvement of the electrical and magnetic properties of many of the company's products, including investigations of the metallurgical behaviour of nickel-chromium alloys by observations of electrical resistance and the study of the magnetic properties of carbonyl iron powders. He has also advised on many of the instrumentation problems of the laboratories.

On page 603 of this issue we mention the formation of Lancashire Dynamo Nevelin, Ltd., and give a brief description of the company's works at Oxted, Surrey. We reproduce a photograph showing Mr. S. F. Steward, C.B.E., managing director of the Lancashire Dynamo Group, with some of the directors of the company.

Mr. V. W. Press, one of the two new directors, joined Lancashire Dynamo & Crypto, Ltd., twenty-two years ago. In 1937 he was appointed to the London sales staff, becoming London manager in 1951. He was made sales and contracts manager of Lancashire Dynamo Switchgear in 1955. As a director of the new company he has taken over responsibility for the sales of Nevelin rectifier products.

Mr. W. R. Jones, the other new director, joined the Nevelin Electric Co. as a senior design engineer in 1950 and became chief engineer in 1951. He was formerly at the Trafford Park Works of Lancashire Dynamo & Crypto, having been assistant manager in the Planer Department from 1937 to 1950.

Mr. V. W. Press, Mr. S. F. Steward, Mr. W. R. Jones and Mr. A. Newing (managing director, Lancashire Dynamo Nevelin, Ltd.)

Mr. J. Taylor

Mr. H. H. Eaton

Lancashire Dynamo & Crypto, Ltd., announces that from 1st October the position of commercial manager at its Trafford Park Works has been taken by **Mr. J. Taylor,** in succession to **Mr. H. H. Eaton.** Mr. Taylor has been with L.D.C. for seventeen years; he served an apprenticeship with the B.T.H. Co. and was for many years a consulting engineer with his own practice in Manchester.

Mr. Eaton has been with the company for fifty-three years. He took charge of the Estimating and Contracts Department in October, 1932, becoming manager of the Estimating Department in 1937 and commercial manager in January, 1954. He has been the L.D.C. representative on committees of several trade groups allied to B.E.A.M.A. Mr. Eaton will continue to be associated with Lancashire Dynamo & Crypto in a consultative capacity.

Mr. R. Woodhead, chief electrical designer with Wright Electric Motors (Halifax), Ltd., is retiring on 31st October after fifty-two years' service with the company.

Mr. J. W. Ridley, B.Sc.(Econ.), has been appointed sales manager to British Physical Laboratories, Ltd., Radlett, and the Quadrant Meter Co., Ltd. Mr. Ridley joined British Physical Laboratories at the beginning of this year, and was previously with Magnetic & Electrical Alloys, Ltd.

The Belmos Co., Ltd., announces that **Mr. B. J. Randall** has joined the company as sales engineer and is operating from its London office at Columbia House, Aldwych, W.C.2.

Mr. W. B. Lane, managing director of Rapid Magnetic Machines, Ltd., is making a world trip with a view to increasing exports of the company's specialised separation, extraction and lifting equipment. He will visit India, Ceylon, Singapore, Australia, New Zealand, the United States and Canada.

Mr. A. H. Elliot has been appointed a director of Hoover, Ltd. He is an executive vice-president of the Iricon Agency, Ltd., is this year's president of the American Chamber of Commerce in London, and is on the executive committee of the Pilgrims and a member of the Fulbright Commission.

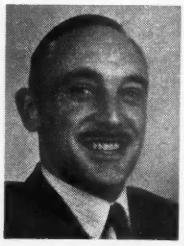
A recent visitor to the Stafford Works of the English Electric Co., Ltd., was **Sir George Seel,** Senior Crown Agent for Overseas Governments and Administrations. He is seen in the accompanying picture signing the distinguished visitors' book, watched by Sir George Nelson, chairman of the company. During the visit **Mr. R. W. Taylor,** engineer in chief, Crown Agents for Overseas Governments and Administrations, gave the opening address of the 1956-57 session of the English Electric Co., Ltd., Stafford Works Engineering Society. His subject was "The Work of the Crown Agents for Overseas Governments and Administrations."

Sir George Seel signing the distinguished visitors' book at the Stafford Works of the English Electric Co., Ltd. With him is Sir George Nelson

Honorary certificates have been awarded by the Carnegie Hero Fund to two employees of the North Eastern Electricity Board, who rescued a 14-year-old boy after he had climbed

a pylon carrying 66 kV cables at Herrington Burn, Co. Durham. The recipients are **Mr. Ronald Ayre,** substation superintendent, and **Mr. James Heggins,** electrician. The boy received severe burns and died later in hospital.

Mr. D. J. Marsh, B.Sc., A.M.I.E.E., A.M.Amer.I.E.E., manager of the Alternator Department of Richardsons Westgarth (Hartlepool), Ltd., is resigning his position to take up an appointment as manufacturing engineer with the Canadian Westinghouse Co., Ltd., Hamilton, Ontario, at the end of October. He took his degree at the University of Leeds, after being a probationary college apprentice with the Metropolitan-Vickers Electrical Co., Ltd. After war service with the Technical Signals Branch of the R.A.F. he returned to Trafford Park to complete his course, and subsequently served in the Plant Engineering Design Department. In 1949 he was appointed assistant manager of the Alternator Department of Richardsons Westgarth and was promoted manager in 1952.



Mr. D. J. Marsh

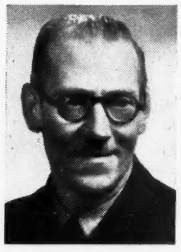
Mr. Marsh is succeeded by **Mr. D. F. Davidson,** B.Sc., A.M.I.E.E., who was educated at Glasgow Technical College and was actively concerned with the early development of hydrogen cooling of turbo-alternators with the Metropolitan-Vickers Electrical Co., Ltd. He joined Richardsons Westgarth as assistant manager of the Alternator Department in 1952.

Senior officials of electricity supply undertakings in Western Germany, at present touring Britain, visited the headquarters of the **Midlands Electricity Board** on 20th and 21st September, where they were received by the deputy chairman of the Board, Mr. D. P. Sayers. The visiting party, led by Herr Leo B. Rohe, included directors, accountants, secretaries and commercial officers representing the Association of German Electricity Supply Undertakings; they also visited the Dudley District of the Midlands Board and Hams Hall power station. The picture reproduced below shows the visitors with some of the principal officers of the M.E.B.

The monthly luncheons of the **Batti-Wallahs' Society** were resumed last week, after the holiday month, when the guest speaker was Mr. T. C. Bailey of the Shell-Mex Co., whose address was on "The Romance of Oil," in which he gave an interesting review of the history of the oil industry. Mr. W. C. M. Couch (president) was in the chair and a vote of thanks was proposed by Mr. R. H. Gummer.

The next luncheon of the Society will be on Wednesday, 31st October, when the guest speaker will be Sir Archibald Gordon.

Mr. F. B. Baker, office manager, Electrical Department, joined Bulpitt & Sons, Ltd., in September, 1906, and has completed fifty years with the company, serving under three generations of the Bulpitt family. He started in the General Sheet Metal Department, passing to Admiralty, War Office and Ship Building Contracts Department, before joining the Electrical Department on its formation over forty years ago. The occasion is being marked by presentations from the directors and his colleagues on the staff.



Mr. F. B. Baker

OBITUARY

Mr. H. G. Baggs.—The death has occurred at the age of eighty-seven of Mr. H. G. Baggs, who joined the staff of Dorman & Smith, Ltd., in 1893 and retired in 1937. He was chairman from 1930 to 1937, since when he had been living in retirement at Newton Ferrers.

Mr. R. A Parsons.—The death occurred very suddenly on 20th September of Mr. Richard A. Parsons, A.M.I.E.E., director of Parsons of Gloucester, Ltd. Mr. Parsons was born at Caerwent, near Chepstow, in 1876 and after education at the Merchant Venturers' College, Bristol, received practical training with King, Mendham & Co. in the same city. After a period with Arnold & Co., of Newport, Mr. Parsons started business as an electrical contractor in 1900 and his firm was eventually registered as a company with Mr. Parsons as director.

The late Mr. R. A. Parsons

For about fifty years Mr. Parsons had been an active member of the Electrical Contractors' Association; he was hon. secretary of the Gloucester branch from 1906 to 1936 and of the Western Sectional Board from 1924 to 1932 and he had been a vice-president and member of the E.C.A. Council for many years. He contributed a regular commentary to the Association's journal, under the pen-name of "Pilgrim Two," for about twenty years. He was also responsible for a collection of many interesting examples of early electrical equipment.

German electricity supply officials with M.E.B. officers at the Board's headquarters

British Central Electrical Co. Exhibition

The British Central Electrical Co., Ltd., held its seventh electrical engineering exhibition and cocktail party on 28th September, at Grosvenor House, Park Lane, W., when nearly 1,000 guests and friends attended, many coming from far afield, including the Midlands and the West Country; overseas visitors came from France, Italy and Germany.

In addition to the equipment shown by the B.C.E. Company there was also exhibited a very comprehensive display of products by the following companies:—A.E.I. Lamp & Lighting Co., Ltd., Cayson Electrics, Ltd., Chilton Electric Products, Ltd., General Electric Co., Ltd., Hurseal, Ltd., and Sealdraught, Ltd. The guests, who comprised senior company officials from the works management, directorate and purchasing staffs of many of the big industrial organisations in Southern England and the Midlands, were received by the managing director, Mr. Gordon Conradi, and Mrs. Conradi. Mr. Conradi, in a short speech, referred to the fact that his company was approaching its fiftieth anniversary. An excellent cabaret was provided.

INDUSTRIAL NEWS

Nuclear Power Station Tenders

LAST Monday the tenders of the four British groups for the construction of the first nuclear power stations to be built by the Central Electricity Authority, at Bradwell (Essex) and Berkeley (Glos.), were delivered to the Authority.

As will be gauged from one of the accompanying pictures, a tremendous weight of paper was involved. The other picture shows Lord Citrine, chairman of the C.E.A., opening the key documents of the tenders.

Right: Crates containing the nuclear power station tenders delivered to the C.E.A. Above: Lord Citrine examines key documents; on his right are Mr. J. Eccles (deputy-chairman) and Mr. F. W. Smith (chief contracting officer) and on his left Mr. J. D. Peattie (acting chief engineer) and Mr. J. C. Duckworth (nuclear power engineer)

Atomic Power Development

At a meeting in London last week Mr. H. West, director and chief electrical engineer of the Metropolitan-Vickers Electrical Co., Ltd., spoke of the activities of the A.E.I. John Thompson Nuclear Energy Co., Ltd., of which he is managing director. With him were Mr. E. W. Thompson, chairman and joint managing director of John Thompson, Ltd., and Mr. O. M. White, director and chief electrical engineer of Balfour, Beatty & Co., Ltd., who are members of the group. The A.E.I. John Thompson Co. is one of the four groups which have prepared and presented tenders for the first of the atomic power stations to be built by the Central Electricity Authority. It was stated at the meeting that by improved techniques it had been possible to raise the output of these stations to between two and three times that originally estimated. This would result in a substantial lowering of the capital cost per MW.

In the course of his remarks Mr. West said that the Metropolitan-Vickers Co. had just received what was believed to be the first export order for atomic power equipment. The contract was for 20 MW of generating plant for the first Canadian atomic power station.

The value of the order to which Mr. West referred is $620,000 (£224,000). The power station, which will be owned by the Ontario Hydro-Electric Power Commission and operated as part of its 230 kV system, will be situated at Des Joachims on the Ottawa River nearly 150 miles north-west of Ottawa. It will comprise a nuclear reactor (to be built by the Canadian General Electric Co. to the design of Atomic Energy for Canada, Ltd.), boiler plant, and generating plant with an output of 20 MW.

The Metropolitan - Vickers contract, which was obtained against competition from home and abroad, is for a 20 MW 3,600 r.p.m. turbine-generator set with associated condensing and feed water heating plant, all of which will be made at the company's works at Trafford Park and Germiston. The turbine is designed to take dry saturated steam at a pressure of 400 lb/sq in and an interesting feature is that despite the low inlet steam conditions the wetness at exhaust is no greater than is normal on sets operating at much higher pressures and temperatures. The air-cooled generator will operate at a power factor of 0·85, generating at 13·8 kV three-phase 50 c/s. This station, which will cost some $14 million, is expected to be in commission by July, 1959, and the M-V plant is to be ready for operation by March of that year.

Engineering Wages Claim

We have already reported that the Confederation of Shipbuilding and Engineering Unions has decided to present a claim for a substantial increase in wages for members of the constituent unions employed in the engineering industry, although the Engineering Employers' Federation had stated that no claim for further wages could be entertained. It was announced last week that, in spite of their declared attitude, the employers would hear the unions' arguments at a meeting on 25th October in order to conform with the established negotiation procedure. The claim will then be referred to the Federation's member firms whose views will form the basis of a reply to the unions to be given at a later meeting.

Another American Contract for English Electric

Reuter reports from Washington that the English Electric Company has secured an order valued at $12 million (£4,285,000) for turbines at the Priest Rapids dam on the Columbia River.

Grant County Public Utility District Commissioners, when announcing the decision, said it was reached to prevent delays on the project caused by a taxpayer who brought a suit to prevent dearer American turbines being used.

The main contractors' original bid on the Priest Rapids dam and power house was based on the cheaper English turbines. Later, the Commissioners decided to switch to Allis-Chalmers turbines, at an added cost of about $500,000 (about £178,600) because, they said, the American firm had more experience in making such turbines.

The taxpayer's legal suit to prevent the change, it was stated, would consume six months or more and this delay, combined with the effect of the river's high water stages, would set the project back at least a year at a time when additional electric power was badly needed in the area. The main contractors were unwilling to order the American turbines until the suit was settled and preliminary work on the dam site had already started.

The equipment involved in this case

is part of a $24 million (about £8 million) contract which the English Electric Co. has received from the main contractors of the Priest Rapids Dam, the Merritt-Chapman & Scott Corporation, New York. The whole order covers eight 114,000 h.p. water turbines and eight 83,000 kVA generators. Each pair of generators will be coupled to a 183,000 kVA 13·2/230 kV transformer; five of these (including one spare) are also being provided by the English Electric Co.

New Metropolitan-Vickers Factory

The Metropolitan-Vickers Electrical Co., Ltd., has acquired a new factory at Huyton, near Liverpool, for the production of industrial control gear. The new works will eventually employ about 750 people; production will start shortly.

The site for the new factory, which has been leased from North Western Industrial Estates, Ltd., is situated in Wilson Road, Huyton. It covers an area of over 180,000 sq ft and contains a partially completed factory (formerly used by Hosemaster Machine Co., Ltd.), consisting of a two-storey office block with single-storey manufacturing bays behind. When finished these buildings will occupy about 100,000 sq ft, leaving ample room for additional workshops, offices, canteens, and so on.

Apart from a few key men from the company's Trafford Park Works, it is hoped to staff the factory entirely from Huyton and the surrounding area.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM ingots	ton £197 0s 0d
COPPER, H.C. Electro	ton £292 5s 0d
Fire Refined 99·70%	ton £291 0s 0d
Fire Refined 99·50%	ton £290 0s 0d
COPPER Tubes ..	lb 2s 10⅝d
Sheet	ton £363 0s 0d
H.C. wire and strip ..	ton £327 10s 0d
LEAD, English ..	ton £116 15s 0d
Foreign	ton £115 0s 0d
MERCURY	flask £83 10s 0d
TIN, block (English) ..	ton £785 5s 0d
ZINC, G.O.B. Foreign	ton £95 0s 0d
Electrolytic	ton —
BRASS Tubes (solid drawn)	lb 2 4⅜d
Sheet	ton £297 5s 0d
Wire	lb 3s 0½d
PHOSPHOR BRONZE Wire	lb 4s 5⅜d
PLATINUM	oz £34 0s 0d
RUBBER, No. 1 R.S.S. spot	lb 27d—27⅛d

Atlas Lighting Conventions

The first of a countrywide series of lighting conventions was held by Thorn Electrical Industries, Ltd., at St. Pancras Town Hall on Wednesday this week. Among those who attended were architects, consulting engineers, electricity board officials, electrical wholesalers, contractors and retailers, and hardware dealers, with their ladies. The programme included a showing of the new film, "The Better to See," dealing with the manufacture of Atlas lamps and fluorescent tubes; a stage demonstration of modern lighting with fluorescent colour change by H. Hewitt, including a fashion display; and a demonstration of new lighting sources and fittings by Dr. H. H. Ballin. Similar meetings will be held at the Pavilion, Jephson Gardens, Leamington Spa, on 8th October, Victoria Rooms, Bristol, on 10th October, Lesser Free Trade Hall, Peter Street, Manchester, on 15th October, Royal Hall, Harrogate, on 17th October, and Berkeley Hall, St. Andrew's Halls, Glasgow, on 22nd October.

Extension to B.T.H. Apprentice Residence

On 29th September Mr. E. H. Ball (managing director) laid the foundation stone of an extension to the Apprentice Residence at Coton House, near Rugby, of the British Thomson-Houston Co., Ltd., which, when complete, will increase the accommodation from nearly 300 to approximately 400. Mr. H. E. Cox (manager, B.T.H. Rugby Works) presided, and among those present were the Mayor and Mayoress of Rugby (Alderman and Mrs. A. P. Broome); Alderman W. S. Howard (chairman, Warwickshire Education Committee) with Mrs. Howard; Mr. F. P. B. Browning (assistant Warwickshire county education officer); Mr. W. Cooper (principal, Rugby College of Technology and Arts); Mr. L. J. Davies (director, Research and Education, B.T.H.); Mr. R. V. Davis and Mr. G. C. Knight (the architects); and Mr. L. R. Burgess and Mr. A. Cook (building contractors).

Sign Design Competition

Details were announced at a Press conference last week by Mr. F. F. Newlands, chairman of the Electrical Sign Manufacturers' Association, of the second illuminated sign design competition to be sponsored by the Association.

Eight prizes, totalling £400, will be given for the best designs for illuminated sign displays on two buildings specially drawn for the competition by an architect. The buildings chosen are a garage and motor showrooms, and a music, radio and T.V. store. The first competition held two years ago attracted ninety-three entries, and the Association expects that the present competition, by offering prizes for designs for illuminated displays on two buildings instead of one as last time, will attract an even larger number of entries.

The main object of the competition is to encourage a continual improvement in the design of illuminated signs. It also has considerable promotional value to the illuminated sign industry.

Sir Harold Wernher, chairman of Electrolux, Ltd., inspecting the millionth refrigerator cabinet to be produced by the company at the Electrolux works, Luton

To encourage the younger designers and architectural students to enter, a special prize will be given for the best entry in respect of each building received from a competitor under twenty-one years. Any person (not a firm) may submit as many designs as desired for either or both buildings and the last date for the receipt of entries is 31st January next. The entries will be judged by a panel of experts representing architectural, town planning and advertising interests whose names will be announced later. The prizes will be presented at a luncheon to be held in March next at the Savoy Hotel, London.

Full details of the competition and copies of the rules with drawings of the two buildings may be obtained from the Electrical Sign Manufacturers' Association, 23, Bedford Row, London, W.C.1.

Heating Publicity

A sales promotion folder of its 1956-57 heating season publicity has been issued by Dimplex, Ltd. This includes illustrations of advertisements which will appear in the trade Press and national periodicals. There are a number of leaflets dealing with radiators for domestic, commercial and industrial applications, the new range of electrical appliances, etc., and particulars are given of a block service and display aids.

Clean Air

A supplement to the monthly journal of the Leeds Chamber of Commerce has been published under the title of "Clean Air" (144 pages, 5s, from the secretary, 9, Quebec Street, Leeds, 1), which is said to be the first comprehensive elementary handbook on the Clean Air Act which received Royal Assent on 5th July. An analysis of its provisions is followed by articles prepared by the National Industrial Fuel

Efficiency Service and numerous individual authorities which indicate how the Act may be implemented, explain the Government loan scheme, discuss the characteristics of the various fuels available and consider various associated problems.

Trade with Finland

On Sunday last a B.E.A.M.A. delegation left London on a six-day visit to Finland to investigate electrical export prospects in that country. Mr. D. Maxwell Buist, export director of B.E.A.M.A., is leading the delegation and the other members are Messrs. J. F. Herbert, J. E. Nilson, L. C. Richards, F. Rostron and W. C. Scott. The visit is being made at the request of the Finnish Association of Electricity Supply Undertakings in collaboration with the United Kingdom Embassy in Helsinki and the Board of Trade.

Industrial Engineering Conference

The Society of Industrial Engineers and the Work Study Society are sponsoring a conference, to be held at the Esplanade Hotel, Porthcawl, on 26th and 27th October. The title of the conference is "Work Study and Industrial Engineering in the Small and Medium-Sized Organisation," and its purpose it to show the smaller firms how they may improve their efficiency without heavy capital expenditure, through the application of industrial engineering techniques. Particulars and application forms can be obtained from the Conference Secretary, 15, Alder Avenue, Ystradgynlais, Swansea Valley, South Wales.

An A.E.G. Publication

From the Allgemeine Elektricitäts Gesellschaft, Berlin, we have received a well-produced 92-page cloth-bound book, "Aus Produktion und Entwicklung" ("On Production and Development"), in which the activities of the company during the years 1953-55 are described (in German) and illustrated. A wide range is covered, taking in power plant, switchgear, marine, industrial and traction equipment, lighting fittings and domestic appliances. Many of the 172 illustrations are in colour. The price of the book is DM.11.70.

Provender Milling Equipment

The new provender mill of Eastern Counties Farmers, Ltd., Ipswich, was officially opened recently by Mr. D. Heathcoat Amory, Minister of Agriculture, Fisheries and Food. It incorporates a 1,750-ton silo and up-to-date provender milling equipment, flexibility of operation being an outstanding feature. An electricity supply is obtained from the 6·6 kV ring-main of the Eastern Electricity Board via a switchboard comprising type FG off-load isolator and 250 MVA type VIH2R circuit-breaker. The latter controls a 1,000 kVA 6,600/433 V ON three-phase transformer, whose secondary is connected to a feeder switchboard consisting of a single-tier 1,600 A type AIR airbreak circuit-breaker cubicle fitted with p.f. indicator, kWh meter and maximum demand alarm. From thence power is distributed through two type MC fuse switchboards one eight-circuit and one six-circuit, to the motors driving the mill machinery. These comprise ninety a.c. motors ranging from $\frac{1}{8}$ to 80 h.p. and including both slip-ring and squirrel cage machines and geared motor units. The switchgear, transformer, and motors were supplied by the Metropolitan-Vickers Electrical Co., Ltd., through Henry Simon, Ltd., who provided the machinery.

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Electronic Instruments Exhibition

More than 100 instruments for practically every kind of electronic application will be shown and demonstrated at the special exhibition to be staged by E.M.I. Electronics, Ltd., at the Royal Hotel, Woburn Place, London, W.C.1, from 28th to 30th November inclusive.

Many of the instruments are new types which will be shown for the first time, and they will include measuring oscilloscopes, distributed amplifiers, line selectors, television picture monitors, microwave wattmeters, stroboscopes, tachometers, etc. Special features of the exhibition will be demonstrations of the new photoconductive industrial TV camera channel, and a studio camera channel—the latter incorporating the newly-developed type 10678 Emitron camera now being supplied to the B.B.C. for use in their Lime Grove Studios. The exhibition will be open from 10 a.m. to 6 p.m. daily, and admission will be by ticket only, obtainable (free) from E.M.I. Electronics, Ltd., Hayes, Middx.

Radio Examination Results

The Radio Trades Examination Board and the City and Guilds of London Institute have now published the results of the radio and television servicing certificate examinations for 1956. Entries for both these examinations showed an increase over the figures for 1955, particularly in the radio servicing certificate examination, for which 822 entries were received, representing an increase of 55 per cent. The number of successful candidates was 322. In addition, 185 candidates were referred in the practical test. In the television servicing certificate examination 60 candidates were successful and 51 were referred in the practical test. The next radio servicing certificate examination will be held on 7th, 9th and 18th May, and the next television servicing certificate examination on 13th and 15th May and 22nd June.

Road Warming

Warwickshire County Council, after studying information regarding experiments in electrical heating of roads in the county, has decided that the estimated cost is so high that the work will have to be deferred for the time being, states Mr. David Watson, the county surveyor. The idea is still being developed in North Yorkshire, however. An extension of the electrical road-warming experiment at Ormesby Bank, a steep hill on the Middlesbrough-Whitby road, has been completed in time for a prolonged test on off-peak supplies throughout the coming winter.

Air-Conditioning Exhibition

Air conditioning and dehumidification plant made by Birlec, Ltd., is being demonstrated at an exhibition which is being held by the Midlands Electricity Board in conjunction with the company's Dryer Division at the M.E.B. industrial showrooms, Chester Street, Aston, Birmingham, until 12th October. Principal interest centres on a direct dehumidifier maintaining low relative humidity in a mobile laboratory. A model of a typical dehumidification plant installation is also being shown. Air conditioning equipment exhibited includes the company's smallest air and process gas dryers and both low pressure and high pressure laboratory "Lectrodryers."

Scottish Radio Show

The Radio Industry Council has announced that the Scottish Radio and Television Exhibition will be held at Kelvin Hall, Glasgow, from 22nd May to 1st June next. The exhibition will be the first to be organised by the radio manufacturers since television began in Scotland and will precede by a few months the opening of the first Scottish commercial television station.

G.E.C.'s Overseas Trade

With the annual statement made by Sir Harry Railing, the General Electric Co., Ltd., has issued a well-produced booklet showing how the company's exports have grown over the post-war years and how the chief types of products which it manufactures have contributed to the present total. The booklet also includes a number of excellent illustrations of installations of the company's equipment all over the world.

Mobile Training School

The extension of electrification on the Southern Region, which forms part of the British Railways' modernisation scheme, means that new depots for the servicing and maintenance of electric rolling stock will have to be set up at various points. The training of staff is important, bearing in mind that in the future many will be new to the job or may have been transferred from other duties. In addition, existing staff must be kept abreast of new techniques and new types of equipment. With this in view the Southern Region of British Railways has built a 3-coach instructional train which will travel to the various depots concerned, so as

to avoid the large amount of travelling which would be involved if the staff were required to attend at a central instructional school.

The train consists of three of the older passenger coaches which have been converted for the purpose. The original electrical equipment has been retained so that the coaches form a complete electric train which is self-propelled within the electrified area. The seats and compartments have been removed and the coaches are now fitted with working specimens of all the various items and types of equipment which the depot staff will be required to maintain. There are also panel diagrams showing the working of the electrical circuits with arrangements to permit the instructor to effect circuit faults so that the trainees may learn to diagnose and correct faulty operation of the equipment. In one coach there is a lecture room seating eight persons with a screen and projector. The various grades of staff will be given short courses comprising a number of lectures and demonstrations.

Power Farming Competition

To provide the food the country needs at an equitable price, new and even unorthodox methods must be found of saving labour. And this can only be done, for the benefit of the country as a whole, by the exchange of personal experience on a national basis. To promote this interchange of ideas, *Power Farmer*, in connection with its 7th National Power Conference at Cheltenham in February, is offering £50 for the best account of practical labour saving, ingenuity and good management on a farm not exceeding 150 acres. The winner of this national competition will be given the opportunity of reading his paper at the Conference. A comprehensive summary of the other best labour-saving suggestions will be circulated among farmers later.

Details of the competition can be obtained from the Organiser, National Power Farming Conference, Dorset House, Stamford Street, London, S.E.1.

Drilling Equipment for China

A contract worth £100,000 for the supply of rotary drilling equipment to China has been received by Victor Products (Wallsend), Ltd. The equipment is required in connection with the large scale development of the mining industry in China. Early delivery was stipulated and the first consignment of equipment will be on its way by the end of this month.

Educational

A refresher course for senior works and plant engineers on modern techniques for the engineer will be given this winter, commencing on 23rd October, at the University of Nottingham. The subjects to be covered include welding, corrosion prevention, lubrication, the Clean Air Act, plastics, rubber, electronics, and automatic control. Particulars can be obtained from the hon. secretary, Works and Plant Engineers' Course, 1956, Departments of Civil and Mechanical Engineering, The University, University Park, Nottingham.

E.C.G.D. Nottingham Office

The Export Credits Guarantee Department has opened a new office in Nottingham, under the managership of Mr. T. H. Collinson. For the time being the new office is in temporary accommodation at Block 5, Government Buildings, Chalfont Drive (telephone: Nottingham 77711).

Kenwood Marketing Division

The Kenwood Manufacturing Co., Ltd., announce the formation of a small appliance marketing division, a new sales division for marketing the "Kenwood Minor" and the "Steam-O-Matic" iron and an increasing range of small appliances through general wholesale channels. The "Kenwood Chef," "Major," "Kenmix" and "Roto-blend" and their attachments will continue to be marketed through appointed distributors.

Institute of Welding

The 1956 autumn meeting of the Institute of Welding, to be held in London, will be a joint meeting with the Nederlandse Vereniging voor Lastechniek (Netherlands Welding Society); this is the first time that the Institute has invited a foreign welding society to participate in one of its regular spring or autumn meetings.

The meeting will open with the annual dinner of the Institute at the Park Lane Hotel, Piccadilly, London, W.1, on 31st October, when the principal guest will be Mr. R. Maudling, M.P., Minister of Supply. The technical sessions will be held at the Institution of Civil Engineers, Great George Street, Westminster, S.W.1, and at the Institution of Mechanical Engineers, 1 Birdcage Walk, Westminster, S.W.1, on 1st November, and at the Institution of Civil Engineers, on 2nd November.

Illumination Design Course

The evening illumination design course organised by the E.L.M.A. Lighting Service Bureau, will commence on 22nd October and will continue on each Monday evening until 3rd December. Applications should be made to the manager of the Bureau, 2, Savoy Hill, London, W.C.2.

Trade Announcements

Downes & Davies, Ltd., are moving their Manchester branch from Pall Mall to Chapeltown Street, Manchester, 1, with effect from 29th October. The address of the showroom and offices will be 72, Chapeltown Street and the electrical, radio and goods receiving departments will be on the opposite side of the road. The new telephone number is Ardwick 5292. The new premises are more accessible to transport.

The Derby branch of the **Z Electric Lamp & Supplies Co., Ltd.,** is moving on 10th October to 33-34, Talbot Street, Derby (telephone: Derby 49192).

An agreement has been concluded between **Wolf Electric Tools, Ltd.,** London, and Rallis India, Ltd., Bombay, for the assembly and manufacture in India of Wolf electric tools, and operations have now commenced.

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to the dates mentioned:—

12th October

ELOX. No. 738,926. Class 9. Electrical and electronic apparatus and instruments and parts.—Elox Corporation of Michigan, U.S.A. Address for service, c/o Marks & Clerk, 57 & 58, Lincoln's Inn Fields, London, W.C.2.

VERSIL (design). No. 753,038. Class 9. Electric batteries and accumulators, etc.—Versil, Ltd., Rayner Mills, Liversedge, Yorks.

SINDAK. No. 751,876. Class 9. Electrical apparatus and instruments, calculating machines, checking (supervision) apparatus, etc.—Southern Instruments, Ltd., Frimley Road, Camberley, Surrey.

IRRASIL. No. 754,631. Class 9. Electrical instruments and apparatus; and covered electric wire and cables.—Wandleside Cable Works, Ltd., 106, Garratt Lane, Wandsworth, London, S.W.18.

HYSTAN. No. 755,191. Class 11. Electric heating apparatus. — Hotpoint Electric Appliance Co., Ltd., Crown House, Aldwych, London, W.C.2.

19th October

HEMO. No. 750,910. Class 9. Parts of electrical apparatus and instruments made of plastics.—Healey Mouldings, Ltd., Wolverhampton Road, Oldbury, near Birmingham.

VAMP. No. 750,959. Class 9. Electrical and electronic apparatus and instruments, etc. —Link Aviation, Inc., U.S.A. Address for service, c/o Marks & Clerk, 57 & 58, Lincoln's Inn Fields, London, W.C.2.

NIVETRON. No. 753,176. Class 9. Electronic apparatus for automatically controlling the position of paper in printing machines.—A.B. Inventing, Sweden. Address for service, c/o Gill, Jennings & Every, 51-52, Chancery Lane, London, W.C.2.

CALSIL. No. 754,640. Class 9. Insulated electric wire and cables; scientific apparatus and instruments; and electrical apparatus and instruments.—Stabilag Co., Ltd., Mark Road, Hemel Hempstead, Herts.

PALAMIT. No. 755,964. TRANSPAN. No. 755,966. Class 11. Electric lighting installations.—Mek-Elek Engineering, Ltd., 17, Western Road, Mitcham, Surrey.

Glasgow Technical College

The Royal Technical College, Glasgow, will in future be known as the Royal College of Science and Technology. Announcing this change, the governors state that it has been made to bring the name into harmony with the status of the college as one of the leading institutions in Britain in the field of applied science.

NEW ELECTRICAL EQUIPMENT

Slotted Angles

Two additions have been made to the range of slotted angle equipment manufactured by DEXION, LTD., 65, Maygrove Road, London, N.W.6. The first of these, Dexion "140," is a slotted angle with equal flanges, designed to bolt together with all other Dexion angles. It is smaller than the existing Dexion "225" and "300," and suitable for erection jobs in factories, stores or offices where the strength of the former is not needed, or for lightly stressed members in bigger structures. Dexion "112" is a half-size version of "225" and is now the smallest in the range. It is suitable for models, display stands and frames, small laboratories and workshop frameworks.

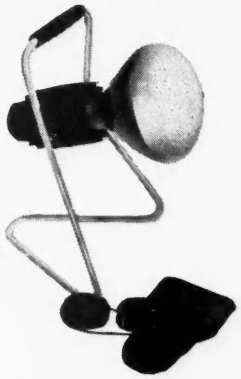
The new sections are available in steel, rust protected and stove-enamelled battleship grey, or aluminium. Prices vary according to the type and length of slotted angle purchased but a typical price for 100ft of Dexion "140," steel, packed in 10ft lengths with 75 nuts and bolts, is £6 0s 10d, up to 500ft. Prices of aluminium alloy angle are available on request, minimum order 200ft.

The company has a comprehensive technical advice service.

Medical Sunlamp

A new sunlamp announced by PHILIPS ELECTRICAL, LTD., Century House, Shaftesbury Avenue, London, W.C.2, is equipped with a mercury discharge quartz tube for emission of ultra-violet rays and a glow filament which also acts as a ballast for the mercury tube. The lamp thus emits both ultra-violet light and comforting warmth.

It is mounted in a handy portable fitting of asbestos-loaded "Philite" which allows the lamp to be pivoted to any convenient angle and when not in use it can be turned downwards so that it requires very little storage space. Special attention has been paid to safety precautions and the use of an additional earthing wire is unnecessary.



Philips' new sunlamp with special goggles in plastic wallet

The lamp is designed for operation on any voltage between 200-250 V a.c. and the consumption is 300 W. A pair of special goggles in a neat plastic wallet is supplied with each lamp.

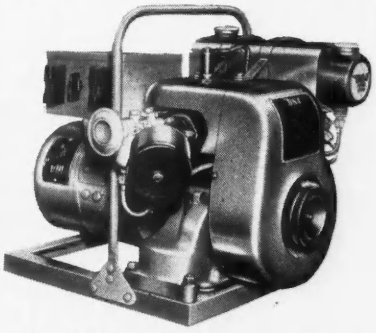
The price of the lamp, which is supplied only against a doctor's certificate, is £5 17s 6d.

Generating Sets

The series of "Elequip" generating sets announced by the ELECTRICAL EQUIPMENT CO. (LEICESTER), LTD., offers a range of five outputs from 500 to 1,800 W. The sets are extremely portable being compactly mounted on a sturdy base and provided with a carrying handle. B.S.A. power units are fitted with a capacity of 120 c.c. (model C) and 220 c.c. (model D). Both are of the single cylinder, 4-stroke, side-valve type and will operate on petrol, vaporising oil or paraffin.

Electrical equipment consists of a close coupled alternator and a switch box. The single-phase alternator is a self-regulating, self-exciting type, producing standard-voltage 50 c/s energy at 3,000 r.p.m. The stator is mounted directly on to the motor shaft. The sheet steel switch box incorporates a pre-set resistor, two fuses, and a main switch.

The dimensions of the complete generators are 23in by 15in by 19in (500 and 800 W models) and 25in by 18in by 23in (1,000, 1,500 and 1,800 W models). The sets are air-cooled and suitable for use under extreme climatic conditions.



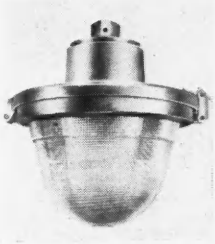
An 800 W "Elequip/B.S.A." generating set

Side Road Lantern

A new street lighting fitting for side road lighting to be known as the "Dagenham" lantern is announced by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2. It incorporates the G.E.C. "Plastifractor" injection moulded bowl refractor optical system.

The refractor bowl is a one-piece injection moulding in "Diakon" and it has a non-axial asymmetric distribution which is highly suitable for side street lighting. Particular attention has been given to achieving an attractive appearance when the lantern is lighted. The method of manufacture ensures a high degree of repetitional accuracy, more efficient light control—because of the high finish obtainable on the prisms—great impact resistance and low weight. The non-axial distribution is obtained by vertical prisms on the outside of the bowl and horizontal prisms on the inside.

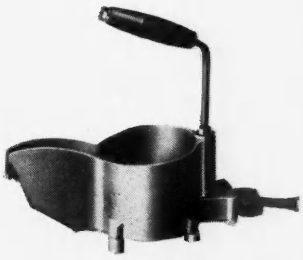
The body of the lantern is a light alloy die-casting arranged for top entry mounting. Provision is made internally for focusing the various wattages of lamp that can be used, ranging from 60 to 150 W.



G.E.C. "Dagenham" lantern

Heated Pitch Ladle

An electrically heated ladle is now available from ALFRED JEFFREY & CO., Marshgate, Stratford, London, E.15, for melting and pouring pitches, waxes, and electrical compounds generally. The ladle consists of a stout cast alloy bowl with a detachable handle. Two heating elements melt the material, one being placed well forward so that the compound is at its maximum fluidity as it leaves the spout. Care has been taken in the design to ensure good balance, so that steady pouring is easy and fatigue minimised.



Heated pitch ladle (Alfred Jeffrey & Co.)

The weight of the ladle is 5½ lb and the charge 1½-2 lb. Working temperatures up to 500 deg F are obtained with a loading of 750 W. The ladle is available for 100/120 V and 230/250 V. It is supplied complete with adequate 3-core cable and detachable plug and the price is £11 10s.

Completion of Rural Electrification

A FIVE-YEAR PROGRAMME

From a Correspondent*

IN a lecture at Seale-Hayne College a short time ago, under the significant title "Electricity in Efficient Farming," Professor H. G. Sanders, the chief scientific adviser of the Ministry of Agriculture, demonstrated, beyond challenge, that, without adequate supplies of electric power, efficient farming is impracticable. Nevertheless, at a time when efficient farming is as essential to the national economy as to farmers themselves, there are still approximately one hundred thousand farms which lack this indispensable aid to technical efficiency.

The principal reason for this is not difficult to locate. It lies in the fact that as, initially, most farm connections are unprofitable, the Electricity Board, which is under statutory obligation to pay its way, is compelled to ask farmers, in most cases, for a capital contribution, and very few small farmers (those principally affected) are able to meet that demand. Furthermore, if they strain their exiguous resources to do so, "one very serious drawback of the capital contribution," as Professor Sanders pointed out, "is that it takes money from the farmer just when he has urgent need of it to equip himself to use electricity to the full; if it limits this equipment it tends to defeat itself."

In other words, small farmers, especially in a period of diminishing profitability, cannot *simultaneously* meet the threefold demand for (1) a capital contribution, even though spread over a period of years, (2) purchase of power units, potentially profitable as these are both in saving labour and in reducing unit costs, and (3) as a corollary, the "full consumption" which alone can render farm connections profitable to the Electricity Board.

New Approach Needed

Manifestly, in a period of capital-cum-credit restrictions, and of increasing financial stringency, it would be wholly futile, and on every ground unjustifiable, to seek a subsidy from general revenues adequate to allow the Electricity Boards to forgo such capital contributions especially as the Herbert Committee has advised the application of "normal economic and commercial tests" to all electricity projects in rural areas. These facts and circumstances do not make rural electrification either less essential, or ultimately less likely to be directly remunerative, than hitherto. They do, however, necessitate a new approach in regard to the financial reservoir from which the substantial funds needed to complete the programme of rural electrification should be drawn.

As no other source of financial support is available, I have suggested to the Government, and to the non-official organisations now negotiating a long-term programme for agriculture, that future farm production grants should include an annual allocation of £10 million to the C.E.A. to enable all farms to be connected within the next five years or so—an essential condition of such a grant being the abolition of the capital contributions from farmers.

I think it is fair to claim that, in effect, such a subsidy would enable small farmers to pay collectively the capital contribution which only a very small percentage of them can afford to pay individually. I go further and affirm that it is wholly useless to appeal to small farmers to achieve the same high level of technical efficiency as big farmers (most of whom already possess electric power) unless in this vital respect they are given equally efficient equipment.

The present piecemeal handling of this problem is, in fact, equally unsatisfactory both to the agricultural and electrical industries, and from every point of view. Unquestionably, the C.E.A. and Electricity Boards are anxious to finish the job as speedily as financial resources permit, and I submit that from the technical as well as the financial angle the five-year programme I have suggested would represent incomparably the most expeditious and efficient way of carrying the whole programme to completion. On the basis outlined, urban consumers would not be subjected to concealed subsidies in aid of rural connections, and—relieved of the capital contribution now demanded from them—the newly-connected farms would be able to advance far more speedily than under present conditions to the "full consumption" which would be invaluable in placing the supply industry on a uniformly profitable basis.

It goes without saying that the rural areas as a whole will benefit if all farms are connected, and to no section of the rural community would such a development be more welcome than to the 600,000 farm workers and their families who are surely fully entitled to this elementary amenity.

Allocation of Grants

The farming community is facing exceptional difficulties this year and, as in 1954, emergency grants may be requested from the Government, as well as relaxations of credit restrictions, to alleviate the financial problems thus created. On the longer view, however, there is no reason to assume that the Minister of Agriculture has abandoned his conviction that fundamental readjustments in the allocation of Government grants to agriculture are desirable and that, in particular, it would be advantageous to allot a larger proportion of the funds available, now running at £220 million, to capital improvements in all relevant categories. As the National Farmers' Union is professedly, and I am sure, genuinely, anxious to divert to small farmers a larger part of the subsidies than they are receiving under the present lop-sided allocations, every project conforming to that objective is now assured of its active support.

The final responsibility rests with the Government. If my proposals involved the slightest addition to the Government's overall expenditure they would neither merit, nor receive, a moment's consideration. What I am urging is the more profitable utilisation of existing, inescapable commitments.

* The author is an economist with practical farming and financial experience.

Electrical Exhibition Film

LAST week we attended the preview of a 30-minute film entitled "Electrical Shop Window of 1956," which dealt with the fifth exhibition sponsored by the Association of Supervising Electrical Engineers and held at Earls Court, London, earlier this year. The cameras take the viewer on a tour of part of the exhibition, since no film could cover in full such a comprehensive display of products, and demonstrate the organisers' claim that the exhibition is an ideal market place for the electrical manufacturer.

Economic Trends in Electricity Supply

Further Conclusions from the C.E.A. Report

By D. J. Bolton, M.Sc., M.I.E.E.

THE report of the Central Electricity Authority for 1955-56 which was reviewed in the *Electrical Review* of 28th September disclosed a number of trends, by no means all favourable, in the development of electricity supply in England and Wales. Superficially, the progress seemed all that could be desired—an increase of nearly 10 per cent in output and 12 per cent in revenue, and a small surplus after meeting all charges and contributions to reserve—but there were two considerable clouds on the horizon. Neither of them had lost the industry any sunshine during the year under review but both promised rough weather in the future. These were the " price freeze " (which the Boards instituted in June and which will affect next year's figures) and the investment restrictions on future plant programmes.

As regards generating plant the past year was highly satisfactory. More plant was commissioned than in any previous year, and in fact slightly more than the programme figure. The plant position, *vis-a-vis* the potential demand, is now probably better than it has ever been since the war, and it might appear that the gap which has been a threat to the country's whole industry for a decade is at last being closed.

But this is a struggle in which there is no finality, and future prospects are less reassuring. Capital investment programmes have been restricted at Government request and in order to keep within the required figure for 1956-57 the Authority has had to postpone work on the construction of some power stations which will considerably reduce the amount of generating plant to be brought into operation in 1958. Area Board programmes have also been curtailed whilst heeding the Government request that rural electrification shall not suffer disproportionately.

South Scotland Severance

In comparing the results with those for the previous year it is necessary to make an adjustment in the totals so as to allow for the loss of the two Scottish Boards and the corresponding generation divisions. Wherever separate figures were available the Authority has itself made this adjustment to the previous year's totals, and in its latest report, comparisons are set out on the basis of England and Wales only. In the case of the consolidated accounts it is not possible to make an exact adjustment, and some approximate assumption has to be employed. For this purpose one can take the total activities of the fourteen Area Boards and of the thirteen generation divisions in 1954-55, as measured in various ways, and find what proportion was attributable to the two Scottish Boards and divisions. This may done as follows:—

1954-55 Figures	per cent
Electricity sales by two Scottish Boards as proportion of total for all fourteen Boards	7·55
Trading revenue of two Scottish Boards as proportion of total for all fourteen Boards	7·31
Installed capacity in two Scottish divisions as proportion of total for all thirteen divisions	6·06
Assets and liabilities transferred to South of Scotland Board	5·81

From these figures it would appear that the activities severed by the Electricity Reorganisation (Scotland) Act of 1954 represented roughly 7 per cent of the output in the year preceding the split. It may be assumed that the dependent activities, including all headquarters operations and expenses, would be affected in something like the same proportion, and in Table I a deduction of 7 per cent from the 1954-55 figures has been employed when making a comparison with 1955-56.

TABLE I.—COMPARISON OF 1955-6 WITH PREVIOUS YEAR (ADJUSTED)

Line	Item	1954-5 £ million	1954-5 less 7 per cent	1955-6 £ million	Inc. or dec. per cent
1	Consolidated revenue ...	364·5	339·0	379·0	11·8
2	Expenses, etc. (lines 1-3)	345·7	321·5	366·9	14·1
3	Consolidated surplus ...	18·79	17·48	12·21	—30·1
	Transfers to Reserves				
4	Supplementary reserve for depreciation ...	10·50		11·70	
5	Taxation reserve ...	nil		—9·44	
6	Central reserve fund ...	1·01		3·00	
7	Area reserve funds ...	4·60		3·05	
8	Total to reserves (net)...	16·11	14·98	8·31	—44·5
9	Unappropriated balance (lines 3-8)	2·68		3·90	

The financial position indicated by these calculations is unmistakable and far from reassuring. Revenue is up by less than 12 per cent and expenses by more than 14 per cent, giving a 30 per cent drop in the surplus. It is true that the supplementary allocation for depreciation of fixed assets which was initiated in 1954 was maintained on a slightly larger scale but this was only made possible by appropriating part of the taxation reserve accumulated in previous years. The latter reserve, set aside for purposes now considered to be unnecessary, has been more than half depleted by this operation, which can therefore only be repeated once more on anything like the present scale.

Turning from general totals to particular performances it is interesting to see how the separate Area Boards have fared in their endeavours to make ends meet and provide a surplus. In Table II the twelve Area Boards of England and Wales are arranged in the order of their proportional surpluses (or deficits), i.e., per cent of total trading revenue. The second column shows the change in the percentage surplus over the previous year. For example, in the first line, the South Western Board made a surplus of 3 per cent of its trading revenue in 1954-55 and 3·06 per cent in 1955-56 which is shown in the second column as an increase of 6 points.

It will be noted that two of the Boards made losses in

TABLE II.—AREA BOARDS' SURPLUSES OR DEFICITS

Area Board	Surplus per cent of Trading Revenue	Change from Previous Year (hundredths)
South Western	3·06	+ 6
Eastern	2·58	+242
Southern	2·50	— 65
London	2·32	+ 27
Midlands	1·71	—126
South Eastern	1·65	—137
North Eastern	1·63	— 80
East Midlands	1·04	— 94
Merseyside & North Wales ...	0·60	—239
North Western	0·53	—182
Yorkshire	—0·22	— 85
South Wales	—0·82	+ 24
Total Area Boards	1·43	— 66

1955-56 (as compared with one in 1954-55) but none of these losses exceeded 1 per cent of the trading revenue. As regards the changes over the previous year, four of the Boards have increased their percentage surplus whilst eight have reduced it. A relatively substantial increase was made by the Eastern Board and reductions of similar magnitude by the Merseyside and North Western Boards. In all cases, however, the surpluses and deficiencies were so small a proportion of the turnover as to suggest the most skilful balancing and a nice adjustment of prices to costs.

Race Between Costs and Efficiency

The possibility of avoiding tariff increases or of keeping them to the absolute minimum depends on the outcome of the never-ending race between rising costs on the one hand and increasing efficiency and technical progress on the other. Usually the cost increases have proved much the speedier: engineering developments and improvements in organisation, though substantial, have rarely succeeded in keeping level.

The Boards' outgoings fall into three major categories, namely, fuel (40 per cent), capital charges (27 per cent), and salaries and wages (21 per cent). The remaining 12 per cent represents materials and services bought out, rates, and other items outside the Boards' control, and can be disregarded for the present purpose. In each of these three categories the unit price which the Boards have to pay has gone up during the year under review, i.e., the price of fuel per ton or per B.Th.U., the rate of interest on capital, and the wage and salary rates.

It does not follow, however, that the Boards' costs per kWh or per kW of demand will have gone up in proportion or indeed at all, because a higher efficiency will enable a given quantity of the purchased article to go further or accomplish a greater output. The three efficiencies which govern the achievements in these three categories of cost are the thermal efficiency of generation, the "capital productivity" of the equipment, and the "labour productivity" of the staff. It is interesting to see how far the improvement in these three efficiencies has gone towards balancing out the corresponding cost increases.

The fuel cost is the simplest of the three to deal with, and here the position can be stated with almost mathematical precision. The average delivered cost of heat (based on the coal price adjusted for calorific value) went up by 10·5 per cent over the previous year. The heat consumption per kWh sent out (the reciprocal of the thermal efficiency) went down by 2·2 per cent. Consequently the fuel cost per kWh went up by approximately the difference between these two figures—actually by 8·1 per cent.

The effect of changes in the capital charges on the equipment is less easy to assess. The average cost per kW of the equipment itself necessarily continues to rise as the proportion of post-war purchases increases. The mean rate of interest on the outstanding borrowings went up from 3·47 to 3·68 per cent, representing a 6 per cent increase in interest payments per unit of capital. To offset this there are slight gains through more effective use of the equipment, employment of larger generating units, etc., but the biggest element in the "capital productivity," namely, the load factor, has unfortunately hardly increased at all. In any case a comparison between only two years may be misleading because of the erratic effect of weather variations, but when the trend of recent years is examined as a whole there is little sign of that improvement in load factor which could alone prevent an increase in the incidence of capital charges.

In the third category, changes in the efficiency of labour utilisation can be judged to some extent by the total number of employees per kW of installed capacity or per kWh sold. Both of these went down by about 7 per cent from the previous year and this went a considerable way towards balancing the increases in wage rates. The overall effect of these two counterbalancing changes can be seen in the total cost of salaries and wages per kWh sold to consumers which increased by 3·2 per cent.

Tariff Increases

The above calculations have shown very clearly that efficiency improvements are not keeping pace with cost increases, and that the financial results of the year's working would necessarily have fallen much below those of the previous year but for certain increases in the tariffs and the automatic increases resulting from fuel-cost clauses. Increases were in fact made by most Area Boards to consumers not covered by fuel clauses, i.e., to non-industrial and the smaller industrial users. The effect of such increases on the mean revenue per kWh is a somewhat complicated one, and depends on the character of the load growth. When the growth is due to additional consumers the tariff increase will produce a corresponding increase in the mean revenue but when the growth is due to an increase in the consumption by existing consumers the effect is very different.

In the present case there was an increase over the previous year in England and Wales of 3·2 per cent in the number of consumers and 6 per cent in the mean consumption per consumer. These two increases combined to produce an overall increase of 9·4 per cent in the total energy sold. Nearly two-thirds of the load growth was therefore due to increased consumption per consumer, and on a block or two-part domestic tariff this results in a lower mean revenue. This effect can be well seen in the domestic field where, in spite of a number of tariff increases, the mean price per kWh rose only by a negligible amount (0·006d—less than one-half per cent). It is true, of course, that any lowering of the mean revenue due to this cause is likely to be matched by a reduction in the mean cost since the costs of distribution per kWh go down with increased consumption per consumer.

Future Position

The importance of the trends disclosed in the present report lies in their effect on the future. The same trends seem likely to continue: increasing efficiencies will only partially compensate for increasing costs and prices, leaving the difference to be covered by tariff increases if financial balance is to be maintained. But in the current year there has been a tariff "freeze" since June last, and no increases are to be made at least until the end of the financial year. How can one possibly expect the Boards all to keep their heads above water in these circumstances, and what becomes of the call for more "self-financing" by the nationalised industries, or of the (very modest) attempt by the electricity industry to build up a supplementary reserve to cover inflated replacement costs?

ELECTRICAL WHO'S WHO

The 1956–57 edition of the "Electrical Who's Who" has been considerably enlarged and contains some 7,000 entries in addition to the index in which names in the biographical section are classified under companies or other organisations. It is available from Iliffe & Sons, Ltd., Dorset House, Stamford Street, S.E.1; the price remains at 21s (postage 1s 5d)

Area Boards' Operations

Importance of Adequate System Reinforcement

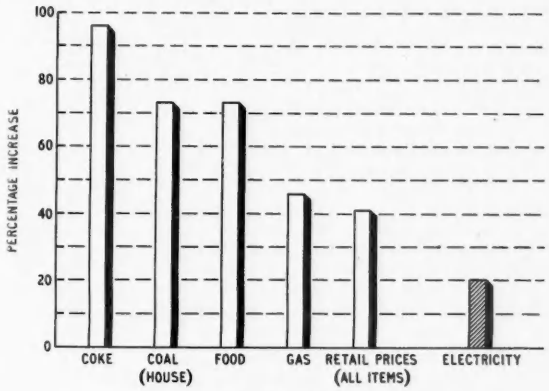
THE report of the Central Electricity Authority for 1955-56, reviewed in last week's issue, gave the trading results of the twelve Area Boards in England and Wales and indicated the general trend of their operations in that year. This account is supplemented in the reports of the individual Boards from which we give below some of the outstanding points of interest.

Conditions generally were more adverse than in the previous year, mainly because of financial restrictions imposed by the Government. The tightening of hire-purchase control and increased purchase tax brought about a decline in sales of electrical appliances, but the cuts in capital expenditure are likely to have their most serious repercussions in years to come. The South Wales Board, for example, has emphasised to the Central Authority and the Ministry the dangers inherent in limiting the amount of system reinforcement and improvement work carried out. So that its programme can be maintained and even accelerated, as is considered essential, the Board has rigorously pruned other types of expenditure. The London Board reports an increased number of breakdowns of old plant on the distribution system, showing the need for replacement at a greater rate than hitherto. Further evidence of this is afforded by the analysis of failures on the lower voltage systems, 44 per cent of which resulted from system defects. Nearly half of the failures occurred on the d.c. sections.

Change-over Retarded

Although supplies to 28,000 consumers in London were changed over from d.c. to a.c. and a further 40,000 from non-standard a.c., there are still 680,000 consumers on d.c. and non-standard a.c. out of the total of 1,716,344 served by the Board. On this subject the Midlands Board points out that the slowing down of the rate of change-over will accentuate its difficulties in giving satisfactory supplies, and the South Wales Board says that the continued existence of non-standard supplies is a source of inefficiency and that deferment of the work of conversion is to be regretted.

In dealing with technical developments, several Boards refer to the extended use of aluminium because of the high price of copper. The Eastern Board has laid experimental



Comparison of price trends in the South Western Area

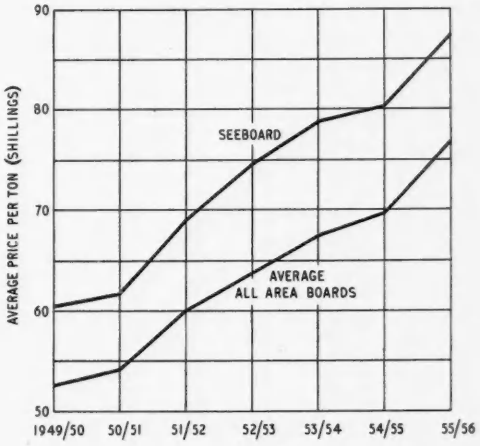
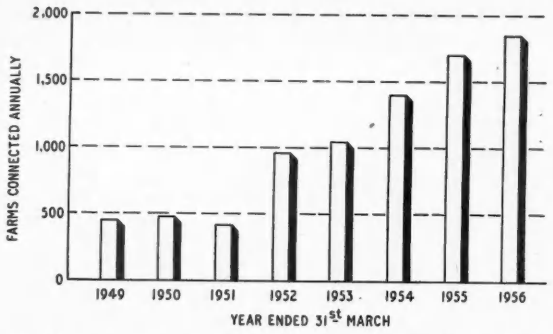


Diagram showing increase in the price of coal (South Eastern Board)

lengths of aluminium underground cables and has placed an order for the laying of approximately three miles of 0·6 sq in oil-filled aluminium cored 33 kV cable, which is believed to be the largest three-core cable of this type in the country. Investigations are proceeding into varied techniques of jointing aluminium-cored cables. The proportion of aluminium-conductor cables used by the Yorkshire Board has been increased to 10 per cent of its total requirements and a further increase to 30 per cent was envisaged at the end of the year. The East Midlands Board also says that it is likely to extend the use of this type of cable but adds that progress so far has been relatively slow because of the need for special training of jointers. The Southern Board has completely gone over to aluminium for conductors on all new l.v. overhead distributors and a similar change in the case of underground cables is in progress. Aluminium alloy conductors have been used as standard on the Board's heavy construction h.v. lines for several years.

Cable Developments

Other matters relating to cables include a report by the Eastern Board that the use of new types of l.v. distribution cables, in some of which plastic insulation and sheathing are employed, is being investigated under service conditions. In conjunction with E.R.A. and cable manufacturers, tests have been started with a view to determining to what further extent the present accepted current carrying capacities of underground cables can be raised. To reduce the duration of interruptions due to faults in rural networks, the same Board is experimenting with a design of 11 kV polythene insulated cable with dry joints and terminating arrangements. This cable can be quickly laid along hedgerows and enables short lengths of underground cable or overhead line to be bridged and taken out of service. Because of the increasing number of interruptions caused by swans flying into h.v. overhead lines, the Board is experimenting with the use of p.v.c. insulated conductor on sections particularly liable to incidents of this kind. Such insulation is used also at crossings of P.O. lines and the Southern Board says that it has gained considerable



Progress of farm electrification in the Merseyside and North Wales Area

advantage from the national agreement permitting this form of protection as an alternative to costly cradle guards.

The South Western Board records that the use of 11 kV jumper cables previously mentioned has been extended and a technique has been developed for jointing lengths of these cables very speedily by spreading the three phases out on spider arms at the top of a light tubular pole; by this means it is possible to carry out maintenance and repairs on up to a mile of line at a time.

An experimental h.v. single-phase earth return line for sparsely populated areas was brought into service last year in the Southern Area and further work is being undertaken to gain more experience.

In supplying farms and isolated premises, the East Midlands Board has made more use of small pole transformers on 11 kV networks in preference to extending l.v. overhead lines. Describing various other economies in line construction, the Board says that the use of an overhead earth wire has been largely discontinued. Mechanical aids such as pole hole boring machines, power driven saws and road boring appliances have been more extensively used by the Eastern Board, which has also investigated the adaptation to its requirements of machines designed primarily for other purposes. As a result, an excavating machine is being employed to dig holes for 33 kV double circuit "H" pole lines. Trial flights have been made with helicopters as an aid to overhead line route surveys.

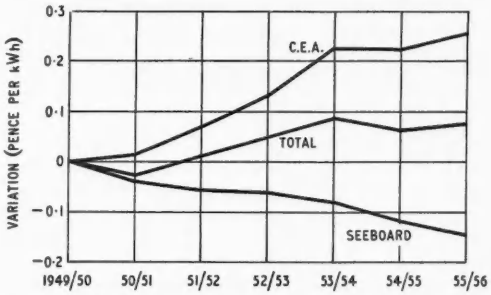
Distribution developments referred to by the Midlands Board include a standard layout for m.v. mains on housing estates; a simplified construction of indoor substations; extension of the use of automatic circuit reclosers; and greater use of the practice of "hot line" working.

The South Western Board reports that it has carried out research for the Central Authority on the economics of cooling a substation by means of a heat pump and selling the recovered heat to consumers in the vicinity.

To gain operational experience with transformers having cold-rolled grain-oriented steel cores the Yorkshire Board has ordered several 12·5 and 18·75 MVA units with cores of this material. Other developments noted are the putting into service of 66 kV isolators fitted with interrupter heads; an improved method of fencing off dangerous areas in live outdoor substations; a new technique for lowering injured persons from wood poles; and the use of fault recorders of a simplified type (Masson-Aked).

Weather conditions during 1955-56 were more severe than in the preceding year and blizzards caused extremely serious damage, particularly in Lincolnshire (East Midlands and Yorkshire Boards) where the work of restoration under appalling conditions drew messages of congratulation from the Minister of Fuel and Power and Lord Citrine. The story of this work is told in a special appendix to the East Midlands Board's report.

As will be seen from the accompanying table, load factors were in the majority of cases less favourable than in 1954-55, ranging from 39 per cent in London to 59·3 per cent in South Wales, but in four Areas (South Western, East Midlands, South Wales and Yorkshire) there were small improvements. Three of the northern Boards experienced their maximum demands in December, the East Midlands Board in January and the remaining Boards in February. In six cases the period was in the evening, for the most part between 5 and 6.30 but in the North Eastern Area rather earlier (4.30 p.m.). The Southern, East Midlands, Midlands and North Western Boards' peak loads occurred in the morning and that of the South Western Board at noon.



Cost of electricity per kWh sold in the Seeboard Area, with proportion attributable to the Board

Increased Domestic Load in South West

The highest rate of increase in sales (12·7 per cent) was achieved by the South Western Board which points out that, in view of the importance of the domestic load to the trading economy of the Area, the increase of 13·6 per cent in supplies to this class of consumer is particularly encouraging. In the past three years the average consumption per household has risen by 18·3 per cent. It stresses the importance of a balanced load in spreading the relatively high costs of providing and maintaining supplies in its largely rural area and so far, despite the financial restrictions, there has been a noteworthy expansion of electrical appliance sales; more than 30,000 water heaters were installed last year, twice as many as in the previous year, while increased sales of cookers, refrigerators and washing machines also contributed to a better load factor.

SIMULTANEOUS MAXIMUM DEMAND AND LOAD FACTOR

Board	Maximum demand MW*		Time		Load factor, per cent	
	1954-55	1955-56	1954-55	1955-56	1954-55	1955-56
London	1,776	1,967	5.30 p.m., 17/1/55	5.30 p.m., 21/2/56	40·4	39·0
South Eastern	973	1,146	5.0–5.30 p.m., 13/1/55	5.30–6.0 p.m., 2/2/56	44·2	41·5
Southern	1,159	1,320	5.0 p.m., 13/1/55	9.30 a.m., 20/2/56	44·5	43·2
South Western	595	650	12.30 p.m., 24/2/55	12 noon, 22/2/56	44·9	45·0
Eastern	1,563	1,757	5.30 p.m., 20/1/55	6.30 p.m., 2/2/56	45·0	43·7
East Midlands	1,321	1,419	8.30 a.m., 14/1/55	8.30 a.m., 16/1/56	46·1	46·5
Midlands	1,769	1,905	9.0 a.m., 13/1/55	9.0 a.m., 22/2/56	45·6	45·0
South Wales	791	849	†	†	59·1	59·3
Merseyside & N. Wales	915	1,008	5.30 p.m., 17/1/55	5.0 p.m., 20/12/55	51·3	51·1
Yorkshire	1,647	1,785	10.0 a.m., 17/1/55	5.0 p.m., 13/12/55	47·6	47·8
North Eastern	886	968	8.30 a.m., 14/1/55	4.30 p.m., 20/12/55	52·6	50·9
North Western... ...	1,883	2,021	8.30 a.m., 17/1/55	9.0 a.m., 3/2/56	46·0	44·9

* Net purchases from Central Authority and other Area Boards.
† Not stated.

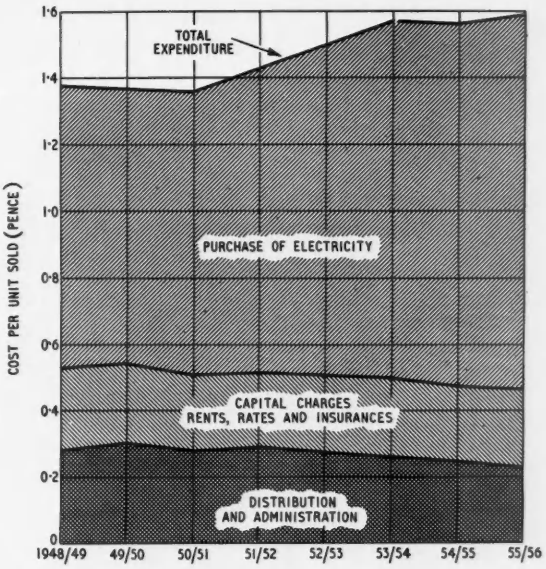
The East Midlands Board reports that while cash sales of appliances increased by nearly 16 per cent to £571,431, hire-purchase sales were 28 per cent lower at £911,749. It also expresses regret that it has been compelled under national agreement to cease the hire of new appliances, saying that the simple hire scheme has always been regarded as an essential part of consumer service. The North Western Board points out that, through being unable to provide new electric cookers for hire, it will be involved in excessive maintenance costs to retain old ones in satisfactory condition. Commenting on the hire-purchase restrictions and increased purchase tax, it says that three important Government objectives will be hampered, namely, hygienic improvements in the handling of food, cleaner air, and better living conditions in old property (in the Board's area there are still several hundred thousand houses without a piped hot water supply).

Because of the large rural electrification programmes in hand before the curtailment of capital expenditure, good progress was made last year and in fact more farms were connected to the supply for the first time than in any previous year. In Merseyside and North Wales, for example, the number of farms served rose by 1,832 as compared with an increase of 1,739 in the previous year; altogether the Board now supplies 17,226 farms whose average consumption last year was 4,406 kWh.

Greater attention is being paid to floor warming and night storage heating. The Eastern Board carried out a vigorous campaign to popularise these types of heating and the Midlands Board also reports very satisfactory progress in this field, with substantial new installations in blocks of flats at Wolverhampton and Birmingham.

The North Eastern Board introduced an off-peak tariff in September, 1955, designed to encourage the use of thermal storage space heaters and some 200 installations of this type, several with loadings in excess of 50 kW, have been connected.

The South Eastern Board stresses that it supplied more consumers and obtained a record showroom and contracting turnover with smaller staff. For the sixth consecutive year the Board's distribution costs were reduced, making a total saving of 22 per cent. This has substantially offset the 30 per cent rise in the "unit" cost of electricity bought in bulk from the Central Authority, so that the average price charged to consumers has risen by less than 7 per cent. During the six years the economies made by the Board are claimed to have saved consumers some £6½ million. Last year, the Board's staff was cut by a further 53, making a reduction of 610 in five years.



Analysis of the Eastern Board's expenditure in pence per kWh sold; distribution and administration costs, which in 1948-49 amounted to 20·4 per cent of the total, now represent only 14·9 per cent

The reports of the Boards also include those of the respective Consultative Councils. Besides representations from consumers, these Councils discussed a wide variety of matters including the report of the Herbert Committee, tariffs, off-peak loads, supplies to housing estates, rural electrification, single-phase or three-phase supplies to farms, simple hire and hire-purchase and assisted wiring.

World Power Conference

FINAL figures of attendance at the fifth World Power Conference held in Vienna last June have now been issued by the Austrian National Committee. These show that 54 countries were represented by 2,923 persons, of whom 1,990 were members. The United Kingdom contingent (the largest to travel outside Great Britain) numbered 396 (239 members). Bound transactions in twenty volumes (about 7,000 pages) will be available next spring at approximately £53 (pre-publication £50). A limited number of pre-prints of general reports and individual papers can be ordered from the British National Committee, 201, Grand Buildings, Trafalgar Square, London, W.C.2, at about 2d per printed page.

The general programme of the sectional meeting to be held in Belgrade from 5th to 10th June next year will be available this November. Applications for membership should be sent to the British National Committee. The Yugoslav National Committee states that 600 participants can be accommodated in first-class hotels in Belgrade and 1,200 in other good hotels. The working languages will be English, French, German and Russian, provision being made for simultaneous interpretation between them. The main conference is to be followed by three alternative study tours.

A provisional technical programme has been drawn up by the Canadian National Committee for the sectional meeting to be held in Montreal from 7th to 11th September, 1958. The next plenary meeting in Australia in 1962 will probably be held in October but the place has not yet been decided upon.

Mr. Cedomil Milicevic (Yugoslavia) has been elected as vice-chairman of the International Executive Council in place of Mr. Franz Holzinger (Austria) who, as previously reported, has succeeded Sir Harold Hartley as W.P.C. president. The other vice-presidents are Dr. A. J. Alves de Sousa (Brazil) and Mr. Gail A. Hathaway (U.S.A.). Sir Vincent de Ferranti has been re-elected chairman of the Council for a second term of six years. The following countries have been admitted as members of the W.P.C.: Costa Rica, Iran, the Philippines and Roumania. Applications have been received from Colombia and Malaya. With these there will be 53 member countries.

DOMESTIC ELECTRICAL EQUIPMENT

Electric Fires

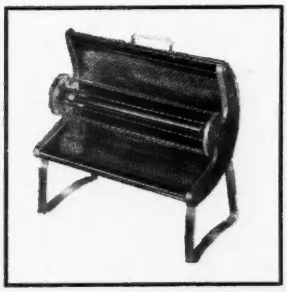
WHATEVER form of room heating is adopted there can be little doubt that as a safe, clean and speedy method of raising the temperature to a comfortable degree the electric fire is the most suitable. The popularity of electric fires is reflected in the large number of manufacturers listed in the following survey and the correspondingly large selection of fires that is now available. We give particulars of almost 400 models.

Most in demand is the reflector type of fire, which provides maximum efficiency with greater concentration of heat and portability. Fitted carrying handles enable it to be transferred from one room to another. There is, however, a growing demand for fuel-effect models and one of Berry's latest "Magicoal" models, the "Minorberry," is available for less than £8, plus purchase tax. Several manufacturers have in fact added to their ranges and many new models for the coming season are listed. The Simplex Electric Co., Ltd., has re-entered the domestic heating field and a new design of a 2 kW "Creda" fire will be marketed early next month.

Unfortunately, the price of this most useful electrical appliance must still carry the burden of purchase tax (60 per cent) but, in general, prices remain at about the same level as a year ago.

Manufacturer	Name or Model	Type	Total Loading	Elements	Finish	Price (excl. Tax)	Purchase Tax
ARTIC FUSE & ELECTRICAL MFG. CO., LTD., Birtley, Co. Durham.	"Sunnyglow"	Portable, floodlit reflector	1¼ or 1½ kW	One 1¼ or 1½ kW rod	Gold, silver, ivory, blue or green to order	£4 16 0	£2 3 2
	"Sunglade"	Portable, floodlit reflector	2½ or 3 kW	Two 1¼ or 1½ kW rod	Gold, silver, ivory, blue or green to order	£9 7 3	£4 4 3
BELLING & CO., LTD., Bridge Works, Southbury Road, Enfield, Middlesex.	"Hotspur" 141 and 142	Portable reflector	1 or 2 kW	One or two 1 kW rod	Bronze or silver green	£2 15 0 (141) £3 10 0 (142)	£1 4 3 (141) £1 10 10 (142)
	"Dinkie" 601 and 602	Portable firebar	1 or 2 kW	One or two 1 kW bar	Bronze or silver green	£1 15 0 (601) £2 15 0 (602)	£0 15 5 (601) £1 4 3 (602)
	"Empire" 401E, 402E and 403E	Portable firebar	1, 2 or 3 kW	One, two or three 1 kW bar	Beige, pastel blue or green vitreous enamel	£2 10 0 (401E) £3 12 6 (402E) £4 15 0 (403E)	£1 2 0 (401E) £1 11 11 (402E) £2 1 10 (403E)
	"Solray" 151 and 152	Portable or wall mounting	1 or 2 kW	One or two 1 kW rod	Cream and black	£3 17 0 (151) £4 18 0 (152)	£1 13 11 (151) £2 3 2 (152)
	"Dainty" 226	Portable firebar	2 kW	Two 1 kW bar	Silver bronze or silver green	£3 15 0	£1 13 0
	"County" 231 and 232	Portable reflector	2 or 3 kW	Two or three 1 kW rod	Silver bronze or silver green	£5 2 6 (231) £6 2 6 (232)	£2 5 2 (231) £2 13 11 (232)
	"Modern" 228	Portable reflector	2 kW	Two 1 kW rod	Silver bronze or silver green	£6 10 0	£2 17 3
	"Cheery" 360	Imitation coal	2 kW	Two 1 kW bar	Silver bronze or silver green	£7 7 6	£3 4 11
	"Homeguard" 155	Portable safety reflector	2 kW	Two 1 kW (concealed)	Silver bronze or silver green	£10 0 0	£4 8 0
	"Celtic" 753B	Period, log	3 kW	Three 1 kW (concealed)	Antique (rustless)	£29 15 0	£13 1 10
	"Adam" 743B	Period, coal	3 kW	Three 1 kW (concealed)	Armour bright (rustless)	£28 10 0	£12 10 10
	"Adam" 915 and 916	Period, firebar	2 or 3 kW	Two or three 1 kW bar	Armour bright (rustless)	£10 10 0 (915) £12 10 0 (916)	£4 12 5 (915) £5 10 0 (916)
	"Princess" 212 and 213	Imitation coal	2 or 3 kW	Two or three 1 kW rod	Bronze or silver green	£9 12 6 (212) £10 10 0 (213)	£4 4 9 (212) £4 12 5 (213)
	"Princess" 212A and 213A	Imitation log	2 or 3 kW	Two or three 1 kW rod	Bronze or silver green	£10 4 0 (212A) £11 2 0 (213A)	£4 9 10 (212A) £4 17 9 (213A)

Manufacturer	Name or Model	Type	Total Loading	Elements	Finish	Price (excl. Tax)	Purchase Tax
BELLING & CO., LTD., Bridge Works, Southbury Road, Enfield, Middlesex. *(continued)*	"Medieval" 639 and 639A	Imitation coal (639) or log (639A)	2 kW	Two 1 kW bar	Antique (rustless)	£12 12 6 (639) £14 2 6 (639A)	£5 11 2 (639) £6 4 4 (639A)
	"Waverley" 263 and 263P	Imitation coal, firebar	3 kW	Three 1 kW bar	Beige (263) or electro-plated bronze (263P)	£16 7 6 (263) £20 10 0 (263P)	£7 4 2 (263) £9 0 5 (263P)
	"Waverley" 264 and 264P	Imitation coal, reflector	3 kW	Three 1 kW rod	Beige (264) or electro-plated bronze (264P)	£17 2 6 (264) £21 5 0 (264P)	£7 10 9 (264) £9 7 0 (264P)
	"Melrose" 273 and 274	Illuminated, firebar (273) or reflector (274)	3 kW	Three 1 kW bar or rod	Beige	£14 5 0 (273) £15 0 0 (274)	£6 5 5 (273) £6 12 0 (274)
	"Converta" 178 and 179	Fireplace screen, firebar (178) or reflector (179)	2 kW	Two 1 kW bar or rod	Ripple bronze	£7 0 0 (178) £7 10 0 (179)	£3 1 8 (178) £3 6 0 (179)
	"Hearth" 159 and 159A	Imitation coal (159) or log (159A)	2 kW	Two 1 kW bar	Bright (rustless)	£7 17 6 (159) £9 12 6 (159A)	£3 9 4 (159) £4 4 9 (159A)
	C/1/131 and C/2/132	Panel, bronze inset	1 or 2 kW	One or two 1 kW bar	Bronze, cream, silver or silver green panel	£3 2 6 (C/1/131) £4 0 0 (C/2/132)	£1 7 7 (C/1/131) £1 15 4 (C/2/132)
	C/1A/131 and C/2A/132	Panel, chromium inset	1 or 2 kW	One or two 1 kW bar	Bronze, cream, silver or silver green panel	£3 12 6 (C/1A/131) £4 18 0 (C/2A/132)	£1 11 11 (C/1A/131) £2 3 2 (C/2A/132)
	F/2/133 (firebar) and G/2/133 (reflector)	Panel, bronze inset	2 kW	Two 1 kW bar or rod	Bronze, cream, silver or silver green panel	£5 7 6 (F/2/133) £5 18 0 (G/2/133)	£2 7 4 (F/2/133) £2 12 0 (G/2/133)
	F/2A/133 (firebar) and G/2A/133 (reflector)	Panel, chromium inset	2 kW	Two 1 kW bar or rod	Bronze, cream, silver or silver green	£6 5 0 (F/2A/133) £6 16 0 (G/2A/133)	£2 15 0 (F/2A/133) £2 19 11 (G/2A/133)
BERRY'S ELECTRIC, LTD., Touchbutton House, Newman Street, London, W.1.	"Adjustaberry" 457	Imitation fuel	2½ kW	Two 1¼ kW bar	Armour bright	£12 7 6	£5 8 7
	"Alderberry" 110	Imitation fuel	2 kW	Two 1 kW rod	Armour bright	£19 10 0	£8 11 1
	"Berrylog" A.21/O	Imitation fuel	1½ kW	Two ¾ kW bar	Satin antique	£10 12 6	£4 13 3
	"Berrylog" A.21/S	Imitation fuel	1½ kW	Two ¾ kW bar	Satin antique	£9 18 6	£4 7 1
	"Emberberry" 108	Imitation fuel	2 kW	Two 1 kW bar	Armour bright	£16 2 6	£7 1 6



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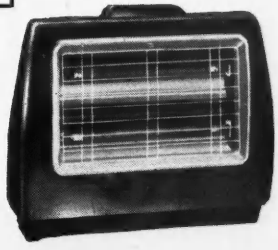

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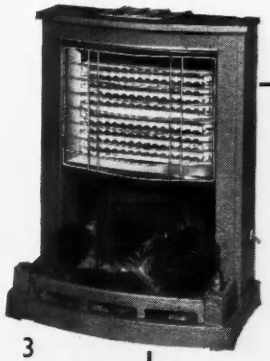
1. Artic Fuse & Electrical Manufacturing Co.'s "Sunnyglow"
2. Belling "Modern"
3. Belling "Cheery" coal effect model
4. Berry's "Alderberry"



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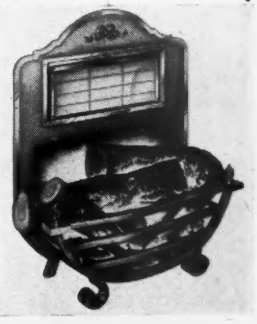

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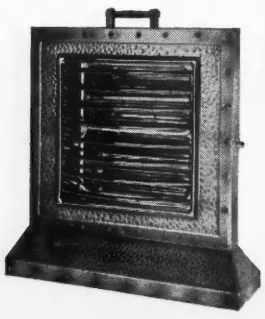
Manufacturer	Name or Model	Type	Total Loading	Elements	Finish	Price (excl. Tax)	Purchase Tax
BERRY'S ELECTRIC, LTD., Touchbutton House, Newman Street, London, W.1. *(continued)*	" Emberberry " 109 (with dogs)	Imitation fuel	2 kW	Two 1 kW bar	Armour bright	£18 8 6	£8 1 8
	" Homeberry " 442	Imitation fuel	2 kW	Two 1 kW rod	Warm silver	£9 12 6	£4 4 5
	" Masterberry " 444	Imitation fuel	2 kW	Four ½ kW rod	Warm silver	£15 0 0	£6 11 8
	" Masterberry " 555	Imitation fuel	3 kW	One 1 kW and one 2 kW bar	Warm silver	£15 17 6	£6 19 4
	" Masterglow " 333	Illuminated radiator	2 kW	Four ½ kW rod	Warm silver	£12 10 0	£5 9 8
	" Mayberry " 441	Imitation fuel	2 kW	Two 1 kW rod	Warm silver	£12 5 0	£5 7 6
	" Minorberry " 468	Imitation fuel	2 kW	Two 1 kW bar	Beige or oyster green	£7 19 6	£3 10 0
	" Vanguard " 628	Portable radiator	2 kW	Two 1 kW rod	Warm silver	£5 19 6	£2 12 5
	" Woodberry " 406	Imitation fuel	3 kW	Two 1½ kW bar	Armour bright	£15 17 6	£6 19 4
	" Adam Shell " 8	Imitation fuel	3 kW	Two 1½ kW rod	Antique bright (rustless)	£43 17 6	£20 10 8
	" Fleur-de-Lis " 40	Imitation fuel	3 kW	Two 1½ kW rod	Armour bright	£34 17 6	£16 6 5
	" Georgian " 2	Imitation fuel	3 kW	Two 1½ kW rod	Antique bright (rustless)	£37 17 6	£17 14 6
	" Jacobean " 5	Imitation fuel	3 kW	Two 1½ kW rod	Armour bright	£29 0 0	£13 11 5
	" Jacobean " 14 (with dogs)	Imitation fuel	3 kW	Two 1½ kW rod	Armour bright	£33 10 0	£15 13 7
	" Queen Anne " Pedestal 11	Imitation fuel	3 kW	Two 1½ kW rod	Antique bright (rustless)	£47 16 6	£22 7 8
	" Regency " 20	Imitation fuel	2 kW	Two 1 kW rod	Antique bright (rustless)	£37 5 0	£17 8 8
	" Wilton " 42	Imitation fuel	3 kW	Two 1½ kW rod	Antique bright (rustless)	£69 0 0	£32 5 10
	" Berrylog " A.28 (Special 36in)	Imitation fuel	—	Log effect only	—	£12 15 6	£5 19 7
	" Berrylog " A.28 (Standard 24in)	Imitation fuel	—	Log effect only	—	£9 0 0	£4 4 3
	Curb Heater 457	Radiator	2½ kW	Two 1¼ kW bar	—	£7 13 6	£3 11 9
	Curb Heater 98D	Radiator	2½ kW	Two 1¼ kW bar	—	£9 0 0	£4 4 3



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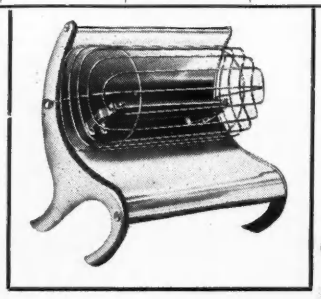

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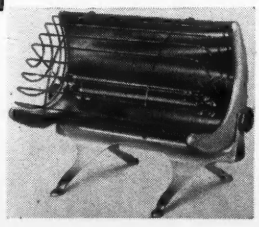

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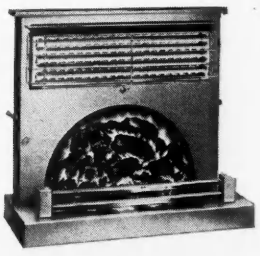
5. *Bulpitt " Cromwell "*
6. *Carron " Curtsey "*
7. *Carron " Crescent "*
8. *Berry's " Minorberry "*
9. *Bulpitt " Waldorf "*
10. *C.W.S. " Derwent "*
11. *C.W.S. " Windsor "*

Manufacturer	Name or Model	Type	Total Loading	Elements	Finish	Price (excl. Tax)	Purchase Tax
BERRY'S ELECTRIC, LTD., Touchbutton House, Newman Street, London, W.1. *(continued)*	Curb Heater 98E	Radiator	2 kW	Two 1 kW bar	—	£9 0 0	£4 4 3
	Curb Heater 98E	Radiator	2¾ kW	Two 1⅜ kW bar	—	£11 15 0	£5 10 0
	"Mistoberry" 417 (Single lighting)	Illuminated radiator	2 kW	Two 1 kW rod	Polished (rustless)	£22 1 0	£9 13 6
	"Mistoberry" 417 (Double lighting)	Illuminated radiator	2 kW	Two 1 kW rod	Polished (rustless)	£24 2 0	£10 11 6
BULPITT & SONS, LTD., St. George's Works, Icknield Street, Birmingham, 18.	"Waldorf" 821 and 822	Portable reflector	1 kW (821) and 2 kW (822)	One or two 1 kW rod	Red, grey, green and beige stoved enamel	£2 1 8 (821) £3 5 0 (822)	£0 18 4 (821) £1 8 6 (822)
	"Woodstock" 831 and 832	Portable reflector	1 kW (831) and 2 kW (832)	One or two 1 kW rod	Gold or silver stoved enamel, black base	£3 19 11 (831) £6 2 6 (832)	£1 15 1 (831) £2 13 9 (832)
	"Cromwell" 795	Portable reflector	2 kW	Two 1 kW rod	Armour bright or brass hammered	£9 4 11	£4 1 1
CARRON CO., Carron, Falkirk.	"Sirius"	Portable firebar	1 or 2 kW	One or two 1 kW bar	Vitreous enamel	£2 2 6 (1 kW) £3 7 6 (2 kW)	£0 18 8 (1 kW) £1 9 7 (2 kW)
	"Curtsey"	Portable reflector	1 or 2 kW	One or two 1 kW rod	"Carrontine"	£2 2 6 (1 kW) £3 1 6 (2 kW)	£0 18 8 (1 kW) £1 7 0 (2 kW)
	Pedestal	Portable reflector	1 or 2 kW	One or two 1 kW rod	Art silver	£2 19 0 (1 kW) £3 19 6 (2 kW)	£1 5 11 (1 kW) £1 14 11 (2 kW)
	"Sunglo"	Portable reflector	2½ kW	Two 1¼ kW rod	Chromium	£8 12 0	£3 15 6
	"Crescent"	Portable reflector	1 or 2 kW	Two 1 kW rod	"Carrontine," cream and gold	£3 16 0 (1 kW) £4 17 0 (2 kW)	£1 13 4 (1 kW) £2 2 6 (2 kW)
CO-OPERATIVE WHOLESALE SOCIETY, LTD., National Works, Hall Street, Dudley.	"Windsor"	Portable reflector	1 or 2 kW	One or two 1 kW rod	Honeydew or copper lustre	£3 3 3 (1 kW) £5 4 9 (2 kW)	£1 8 6 (1 kW) £2 7 1 (2 kW)
	"Eden"	Portable firebar	1 or 2 kW	One or two 1 kW bar	Grey or oyster green	£1 18 8 (1 kW) £2 18 0 (2 kW)	£0 17 5 (1 kW) £1 6 1 (2 kW)
	"Avon"	Portable firebar	1 or 2 kW	One or two 1 kW bar	Grey or oyster green	£1 11 3 (1 kW) £2 6 8 (2 kW)	£0 14 1 (1 kW) £1 1 0 (2 kW)
	"Derwent"	Portable or wall mounting reflector	1 kW	One 1 kW rod	Grey or oyster green	£2 4 6	£0 19 6
	Bowl	Portable reflector	600 W	One 600 W spiral	Chromium, cast base	£1 15 3	£0 15 11



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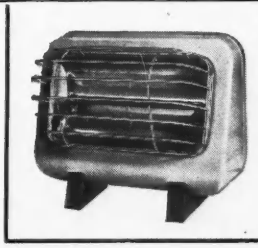

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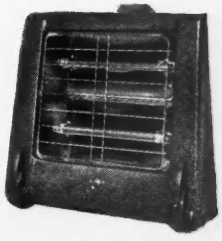

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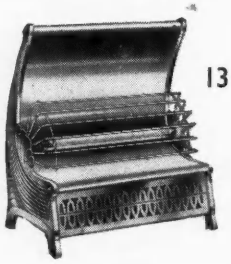

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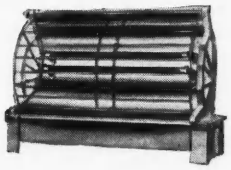

12. *A. D. Davidson "Diamond"*
13. *Cranmer & Cheshire "Nichro" 438*
14. *Crosslands "Raydant"*

Manufacturer	Name or Model	Type	Total Loading	Elements	Finish	Price (excl. Tax)	Purchase Tax
CRANMER & CHESHIRE, LTD., Steward Street, Spring Hill, Birmingham, 18.	"Nichro" 422	Portable tilting reflector	1 or 2 kW	One or two 1 kW rod	Silver grey	£3 5 0 (1 kW) £4 0 6 (2 kW)	£1 8 6 (1 kW) £1 15 4 (2 kW)
	"Nichro" 424	Portable double tilting reflector	2 kW	Two 1 kW rod	Silver grey	£5 10 0	£2 8 4
	"Nichro" 426	Wall fixing (bathroom)	1 kW	One 1 kW rod	Silver grey	£3 6 6	£1 9 2
	"Nichro" 429	Wall fixing (bathroom)	¾ kW	One ¾ kW rod	Silver grey	£3 3 0	£1 7 7
	"Nichro" 430	Portable tilting reflector	¾ or 1½ kW	One or two ¾ kW rod	Silver grey	£2 19 6 (¾ kW) £3 13 6 (1½ kW)	£1 6 1 (¾ kW) £1 12 3 (1½ kW)
	"Nichro" 438	Portable tilting reflector with glow lamp behind grille	2 kW	Two 1 kW rod	Silver grey	£5 15 0	£2 10 6
CROSSLANDS (RUGELEY), LTD., 55, Ebury Street, London, S.W.1.	"Raydant" 800/1 and 800/2	Portable reflector	1 or 2 kW	One or two 1 kW rod	Cream, red, silver or green	£2 7 6 (800/1) £3 4 2 (800/2)	£1 0 7 (800/1) £1 7 10 (800/2)
	"Raybar" 700/1 and 700/2	Portable firebar	1 or 2 kW	One or two 1 kW bar	Red, pale green or silver	£1 15 0 (700/1) £2 15 0 (700/2)	£0 15 2 (700/1) £1 3 10 (700/2)
A. D. DAVIDSON ELECTRIC CO., 62, Granville Street, Birmingham, 1.	"Davey" F.220 and F.221	Portable reflector	1 or 2 kW	One or two 1 kW rod	Chromium on brass	£2 11 6 (F.220) £3 16 0 (F.221)	£1 2 8 (F.220) £1 13 4 (F.221)
	"Diamond" F.230 and F.231	Portable reflector	1 or 2 kW	One or two 1 kW rod	Stone or pastel green	£2 17 6 (F.230) £3 5 6 (F.231)	£1 5 3 (F.230) £1 8 9 (F.231)
	"Davey" Bowl	Portable reflector	600 W	One 600 W spiral	Chromium on brass	£1 7 6	£0 12 1
DEXRAY ENGINEERING CO., LTD., 34, Ardwick Green South, Manchester, 13.	R.23	Portable reflector	2 kW	Two 1 kW rod	Hammer bronze or cream	£6 0 0	£2 14 0
	R.21 and R.22	Portable reflector	1 or 2 kW	One or two 1 kW rod	Bronze	£3 15 0 (R.21) £4 10 0 (R.22)	£1 13 9 (R.21) £2 0 6 (R.22)
	R.10	Portable or inset	2 kW	Two 1 kW rod	Cream or cream/gold	£6 5 0	£2 16 0
	R.15	Wall mounting	1 kW	One 1 kW rod	Cream and black	£3 10 0	£1 11 6
ELECTROWAY HEATERS, LTD., Rosebery Street, Loughborough, Leics.	IR12, VH2 and VH3	Inset, vertical reflector	1, 2 and 3 kW	One, two and three 1 kW rod	Chromium	£2 14 0 (IR12) £3 19 0 (VH2) £5 16 0 (VH3)	£1 3 9 (IR12) £1 14 8 (VH2) £2 11 1 (VH3)
	VK2 and IA2	Inset, vertical (VK2) and parabolic reflector (IA2)	2 kW	Two 1 kW rod	Chromium	£5 19 0 (VK2) £6 18 0 (IA2)	£2 12 4 (VK2) £3 0 8 (IA2)
	IH1R, IH2R and IH3R	Inset, horizontal reflector	1, 2 and 3 kW	One, two and three 1 kW rod	Chromium	£3 5 0 (IH1R) £4 10 0 (IH2R) £7 6 0 (IH3R)	£1 8 6 (IH1R) £1 19 7 (IH2R) £3 4 3 (IH3R)

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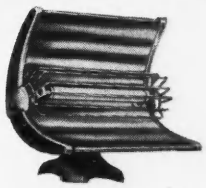

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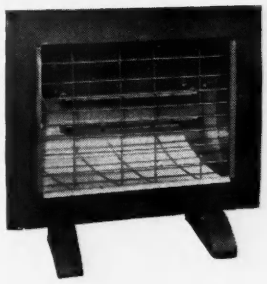

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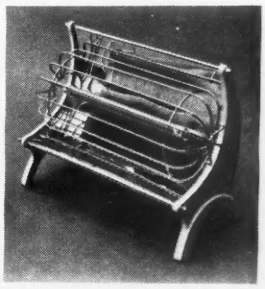
15. *Electroway Heaters model 410*
16. *Dexray R.22*
17. *Endo Industries E.656 bowl fire*

Manufacturer	Name or Model	Type	Total Loading	Elements	Finish	Price (excl. Tax)	Purchase Tax
ELECTROWAY HEATERS, LTD., Rosebery Street, Loughborough, Leics. *(continued)*	IH1, IH2 and IH3	Inset, panel bar	1, 2 and 3 kW	One, two and three 1 kW bar	Chromium	£2 18 0 (IH1) £3 18 0 (IH2) £6 5 0 (IH3)	£1 5 6 (IH1) £1 14 3 (IH2) £2 14 11 (IH3)
	IE1R, IE2R and IE3R	Inset, horizontal reflector	1, 2 and 3 kW	One, two and three 1 kW rod	Stoved enamel	£2 7 0 (IE1R) £3 7 0 (IE2R) £5 12 0 (IE3R)	£0 18 0 (IE1R) £1 9 5 (IE2R) £2 9 3 (IE3R)
	IE1, IE2 and IE3	Inset, panel bar	1, 2 and 3 kW	One, two and three 1 kW bar	Stoved enamel	£2 2 0 (IE1) £3 0 0 (IE2) £4 11 8 (IE3)	£0 18 5 (IE1) £1 6 4 (IE2) £2 0 0 (IE3)
	IG1R and IG2R	Wall, horizontal reflector	1 and 2 kW	One or two 1 kW rod	Stoved enamel	£2 18 0 (IG1R) £4 2 0 (IG2R)	£1 5 6 (IG1R) £1 16 0 (IG2R)
	IG1 and IG2	Wall, panel bar	1 and 2 kW	One or two 1 kW bar	Stoved enamel	£2 14 0 (IG1) £3 7 0 (IG2)	£1 3 9 (IG1) £1 9 5 (IG2)
	WIR12, WVH2 and WVH3	Wall, vertical reflector	1, 2 and 3 kW	One, two and three 1 kW rod	Chromium, stoved enamel plaque	£4 3 0 (WIR12) £5 8 0 (WVH2) £7 5 0 (WVH3)	£1 16 6 (WIR12) £2 7 6 (WVH2) £3 3 9 (WVH3)
	WH2	Wall, panel bar	2 kW	Two 1 kW bar	Chromium, stoved enamel plaque	£5 7 0	£2 7
	WH2R	Wall, horizontal reflector	2 kW	Two 1 kW rod	Chromium, stoved enamel plaque	£6 0 0	£2 12 9
	WE2	Wall, panel bar	2 kW	Two 1 kW bar	Stoved enamel fire and plaque	£4 10 0	£1 19 7
	WE2R	Wall, horizontal reflector	2 kW	Two 1 kW rod	Stoved enamel fire and plaque	£4 18 0	£2 3 1
	IG2F	Wall, ring main, panel	2 kW	Two 1 kW bar	Chromium or stoved enamel	£4 1 0	£1 15 7
	R12	Wall, bathroom or portable	1 kW	One 1 kW rod	Hammered silver stoved enamel	£2 18 0	£1 5 6
	710 and 720	Portable, panel bar	1 and 2 kW	One or two 1 kW bar	Stoved enamel	£1 14 0 (710) £2 14 0 (720)	£0 14 11 (710) £1 3 9 (720)
	71 and 72	Portable, horizontal reflector	1 and 2 kW	One or two 1 kW rod	Stoved enamel	£2 2 0 (71) £3 7 0 (72)	£0 18 5 (71) £1 9 5 (72)
	R2	Portable, twin parabolic reflector	2 kW	Two 1 kW rod	Hammered silver	£5 2 0	£2 4 0
	410 and 410/2	Portable reflector	1 and 2 kW	One or two 1 kW rod	Hammered silver	£3 10 0 (410) £4 10 0 (410/2)	£1 10 9 (410) £1 19 7 (410/2)
ENDO INDUSTRIES, LTD., 97e, Westbourne Terrace London, W.2.	E.256 and E.356	Portable reflector	1 and 2 kW	One or two 1 kW rod	Grey hammer	£1 0 11 (E.256) £1 19 7 (E.356)	£0 8 1 (E.256) £0 15 11 (E.356)
	"Coalarama"	Imitation coal	2 kW	Four ½ kW rod	Bronze hammer	£11 0 11	£4 16 11
	E.656	Portable bowl	600 W	One 600 W spiral	Gold hammer	£0 19 2	£0 7 4

Manufacturer	Name or Model	Type	Total Loading	Elements	Finish	Price (excl. Tax)	Purchase Tax
FALKIRK IRON CO., LTD., Falkirk, Stirlingshire.	41	Portable reflector	2 kW	Two 1 kW rod	Stove enamelled, various colours	£3 1 0	£1 6 9
	" Firefly " 43	Portable reflector	1 kW	One 1 kW rod	Stove enamelled, various colours	£2 1 0	£0 18 0
FALK, STADELMANN & CO., LTD., 91, Farringdon Road, London, E.C.1.	" Serenity "	Portable reflector, illuminated screen	2 kW	Two 1 kW rod	Polychromatic gold	£10 8 6	£4 11 6
	" Felicity "	Portable reflector, illuminated screen	2 kW	Two 1 kW rod	Polychromatic gold or cream	£6 18 8	£3 0 10
	U.95655 and U.95656	Portable reflector	1 and 2 kW	One or two 1 kW rod	Cream with black, green or red feet	£2 12 1 (U.95655) £3 5 4 (U.95656)	£1 2 11 (U.95655) £1 8 8 (U.95656)
	Bathroom U.95670	Wall mounting reflector	1 kW	One 1 kW rod	Cream	£3 2 6	£1 7 6
	U.95708 and U.95709	Portable reflector	1 and 2 kW	One or two 1 kW rod	Bronze, blue and silver or green and silver	£2 12 1 (U.95708) £3 9 6 (U.95709)	£1 2 11 (U.95708) £1 10 6 (U.95709)
	U.95732 and U.95742	Portable reflector	1 and 2 kW	One or two 1 kW rod	Grey	£1 14 9 (U.95732) £2 12 6 (U.95742)	£0 15 3 (U.95732) £1 3 0 (U.95742)
	U.95664	Portable 10in bowl reflector	600 W	One 600 W spiral	Grey or cream	£1 5 0	£0 10 11
	U.95733	Portable 12in bowl reflector	750 W	One 750 W spiral	Cream, chromium bowl	£1 18 11	£0 17 1
FERRANTI, LTD., Hollinwood, Lancs.	" Victor 10 " F.4144	Floor reflector	1 kW	One 1 kW rod	Cream enamel, chromium or solium reflector	£2 14 9	£1 4 0
	" Victor 20 " F.5164	Floor reflector	2 kW	Two 1 kW rod	Cream enamel, chromium or solium reflector	£3 9 6	£1 10 6
	" Victor 25 " F.6175	Floor reflector	2½ kW	Two 1¼ kW rod	Cream enamel, chromium reflector	£5 0 0	£2 3 11
	" New Era 20 " F.4140	Floor reflector	2 kW	Two 1 kW rod	Cream enamel, chromium or solium reflector	£6 16 8	£3 0 0
	" Modera 25 " F.3111	Floor reflector	2½ kW	Two 1¼ kW rod	Silver enamel, chromium reflector or copper enamel, solium reflector	£11 8 4	£5 0 2
	" Glowera 25 " F.3117	Floor reflector, illuminated	2½ kW	Two 1¼ kW rod	Silver enamel, chromium reflector or copper enamel, solium reflector	£12 18 4	£5 13 4
	" Novera 20 " F.3102	Floor reflector	1½ or 2 kW	Two ¾ kW or 1 kW rod	Cream enamel, chromium or solium reflector	£7 16 8	£3 8 9
	" Novera 25 " F.3108	Floor reflector	2 or 2½ kW	Two 1 kW or 1¼ kW rod	Cream enamel, chromium or solium reflector	£8 15 0	£3 16 9
	W.5148	Wall reflector (bathrooms, etc.)	1 kW	One 1 kW rod	Cream or silver, chromium guard and reflector	£3 15 0	£1 12 11
	W.5150	Wall reflector (bathrooms, etc.)	1¼ kW	One 1¼ kW rod	Cream or silver, chromium guard and reflector	£4 10 0	£1 19 6
	" Corona " F.6184	Floor reflector, decorative light effect	2 kW	Two 1 kW rod	Silver enamel, chromium reflector	£10 7 0	£4 10 9
	" Flamera " F.6186	Floor reflector, imitation fuel	2 kW	Two 1 kW rod	Silver enamel, chromium reflector	£10 18 3	£4 15 9
	" Major " P.5158	Builders' fire reflector	2½ kW	Two 1¼ kW rod	Cream enamel, chromium reflector	£8 15 0	£3 16 9
	" Minor " P.5160	Builders' fire reflector	2 kW	Two 1 kW rod	Bronze and cream, chromium or solium reflector	£4 11 8	£2 0 3
	P.3310	Panel reflector, ventilating grille	2½ kW	Two 1¼ kW rod	Chromium reflector, frame and decorative screen	£24 10 6 £3 5 0 (decorative screen)	£10 15 3
	P.33132	Panel reflector	2 kW	Two 1 kW rod	Chromium reflector, frame and guard	£16 2 6	£7 1 6
	P.33122	Panel reflector	1¼ kW	Two ¾ kW rod	Chromium reflector, frame and guard	£12 10 0	£5 9 8

Manufacturer	Name or Model	Type	Total Loading	Elements	Finish	Price (excl. Tax)	Purchase Tax
FORMO PRODUCTS, LTD., 153, Masons Hill, Bromley, Kent.	"Sunnyheat"	Portable reflector	1 kW	One 1 kW rod	Ivory stove enamelled	£1 16 7½	£0 15 10½
H. FROST & CO., LTD., Walsall.	"Sunhouse" 147 and 148	Portable panel bar	1 kW (147) and 2 kW (148)	One and two 1 kW bar	Terra-cotta and satin rustless guard	£2 1 6 (147) £3 0 0 (148)	£0 18 0 (147) £1 6 0 (148)
	"Sunhouse" 261 and 262	Portable reflector	1 kW (261) and 2 kW (262)	One and two 1 kW rod	Chromium and matt black	£2 7 6 (261) £3 3 0 (262)	£1 0 7 (261) £1 7 4 (262)
	"Sunhouse" 163	Bathroom reflector	1 kW	One 1 kW rod	Cream	£3 13 6	£1 11 10
	"Sunhouse" 172 and 172 C.P.	Inset reflector	2 kW	Two 1 kW rod	Brown hammered stoved enamel (172) and chromium (172 C.P.)	£4 8 6 (172) £6 4 0 (172 C.P.)	£1 19 0 (172) £2 14 7 (172 C.P.)
	"Sunhouse" 177 and 177 C.P.	Inset reflector	1 kW	One 1 kW rod	Brown hammered stoved enamel (177) and chromium (177 C.P.)	£2 1 0 (177) £2 14 0 (177 C.P.)	£0 18 1 (177) £1 3 10 (177 C.P.)
	"Sunhouse" A.17 and A.17 C.P.	Inset reflector	2 kW	Two 1 kW rod	Brown hammered stoved enamel (A.17) and chromium (A.17 C.P.)	£3 10 0 (A.17) £4 10 0 (A.17 C.P.)	£1 10 10 (A.17) £1 19 8 (A.17 C.P.)
	"Sunhouse" B.17 and B.17 C.P.	Inset reflector	1 kW	One 1 kW rod	Brown hammered stoved enamel (B.17) and chromium (B.17 C.P.)	£2 3 6 (B.17) £3 7 6 (B.17 C.P.)	£0 19 2 (B.17) £1 9 9 (B.17 C.P.)
	"Sunhouse" A.14 and A.14 C.P.	Inset panel bar	1 kW	One 1 kW bar	Brown hammered stoved enamel (A.14) and chromium (A.14 C.P.)	£2 2 0 (A.14) £3 6 6 (A.14 C.P.)	£0 18 6 (A.14) £1 9 4 (A.14 C.P.)
	"Sunhouse" A.24 and A.24 C.P.	Inset panel bar	2 kW	Two 1 kW bar	Brown hammered stoved enamel (A.24) and chromium (A.24 C.P.)	£3 3 6 (A.24) £4 18 6 (A.24 C.P.)	£1 8 0 (A.24) £2 3 5 (A.24 C.P.)
	"Sunhouse" 4021 and 7021	Inset reflector	2 kW	Two 1 kW rod	Brown hammered stoved enamel	£4 12 0 (4021) £6 16 0 (7021)	£2 0 6 (4021) £2 19 10 (7021)
	"Sunhouse" 7031	Inset reflector	3 kW	Two 1½ kW rod	Brown hammered stoved enamel	£7 4 6	£3 3 7
	"Sunhouse" 401 and 402	Wall panel reflector	1 or 2 kW	One or two 1 kW rod	Brown hammered stoved enamel	£2 9 6 (401) £3 13 6 (402)	£1 1 10 (401) £1 12 4 (402)
	"Sunhouse" 403 and 404	Wall panel bar	1 or 2 kW	One or two 1 kW bar	Brown hammered stoved enamel	£2 7 6 (403) £3 11 6 (404)	£1 0 11 (403) £1 11 6 (404)

18. *Falk Stadelmann's U.95709 "Olympian"*
19. *Falkirk Iron Co.'s "Firefly"*
20. *Formo Products "Sunnyheat"*
21. *Ferranti "Flamera"*
22. *Ferranti "Victor 25"*



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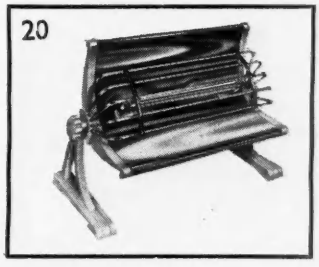

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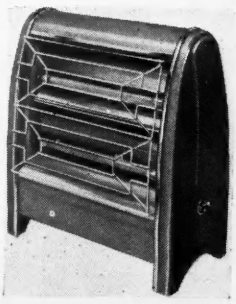

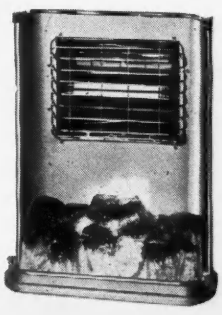

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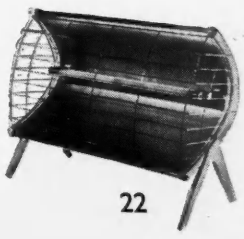

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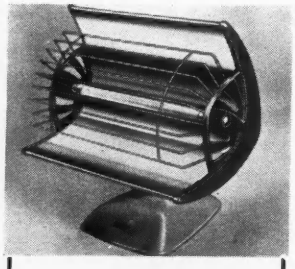
Manufacturer	Name or Model	Type	Total Loading	Elements	Finish	Price (excl. Tax)	Purchase Tax
H. FROST & CO., LTD., Walsall. *(continued)*	" Sunhouse " 4020 and 7020	Wall panel reflector	2 kW	Two 1 kW rod	Brown hammered stoved enamel	£5 9 6 (4020) £8 19 6 (7020)	£2 8 3 (4020) £3 19 0 (7020)
	" Sunhouse " 7030	Wall panel reflector	3 kW	Two 1½ kW rod	Brown hammered stoved enamel	£9 8 0	£4 2 9
	" Sunhouse " A.17/P and 7061	Wall panel reflector	2 kW	Two 1 kW rod	Brown hammered stoved enamel	£4 12 0 (A.17/P) £3 15 6 (7061)	£2 0 6 (A.17/P) £1 13 3 (7061)
G.B.M. (ELECTRICAL) BIRMINGHAM, LTD., 439, Moseley Road, Birmingham, 12.	" Maypole " R.1	Portable reflector	1 kW	One 1 kW rod	Cream and black	£3 14 10	£1 13 2
	" Maypole " R.2	Portable reflector	2 kW	Two 1 kW rod	Cream and black	£4 11 10	£2 0 3
	" Maypole " R.3	Portable reflector (extra large)	2 kW	Two 1 kW rod	Cream and black	£5 14 8	£2 10 4
GATEHILL MANUFACTURING CO., LTD., Crown Works, Crown Yard, Stanhope Street, N.W.1.	" Curzon "	Portable reflector	1 kW	One 1 kW rod	Gold and mushroom	£1 15 0	£0 15 2
	" Richmond "	Portable reflector	1 and 2 kW	One or two 1 kW rod	Gold and mushroom	£1 19 5 (1 kW) £2 4 11 (2 kW)	£0 12 8 (1 kW) £0 19 5 (2 kW)
	" Windsor "	Portable reflector	1 kW	One 1 kW rod	Silver hammered	£1 3 0	£0 9 11
	" Elgin "	Portable bowl reflector	600 and 750 W	600 W or 750 W spiral	Silver hammered	£1 5 0	£0 10 9
GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2.	D.2342G	Portable firebar	2 kW	One 1 kW bar	Beige or green vitreous enamel	£3 16 0	£1 13 4
	D.2391G	Inset	1 kW	One 1 kW bar	Bronze (*a*) or hammered bronze (*b*)	£2 4 0 (*a*) £2 8 0 (*b*)	£0 19 4 (*a*) £1 1 1 (*b*)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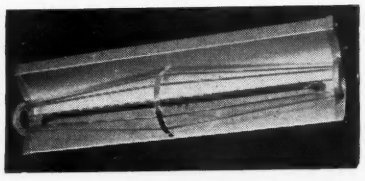
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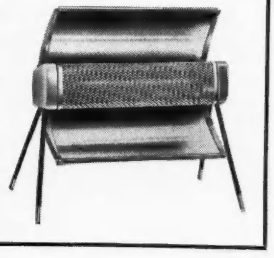
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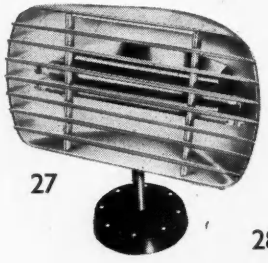
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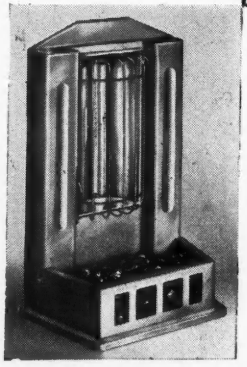
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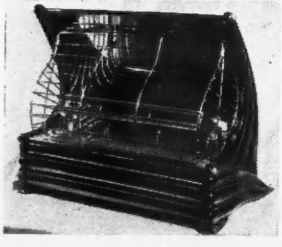
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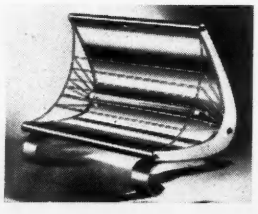
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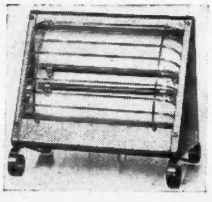
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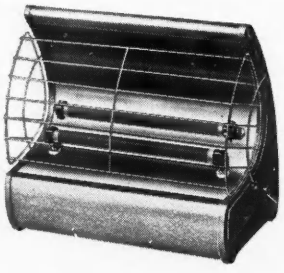
23. *L. G. Hawkins " Loughton "*
24. *Heatrae " Saferod "*
25. *G.E.C. 2 kW D.2775*
26. *Gatehill " Curzon "*
27. *G.E.C. 2 kW pedestal mounted D.2815*
28. *Grafton 750 W coal effect model*
29. *G.B.M. (Electrical) " Maypole " 2 kW model*
30. *L. G. Hawkins " Boomerang "*
31. *Grubb Engineering Co.'s 2 kW model*

Manufacturer	Name or Model	Type	Total Loading	Elements	Finish	Price (excl. Tax)	Purchase Tax
GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2. (*continued*)	D.2392G	Inset	2 kW	Two 1 kW bar	Bronze (*a*) or hammered bronze (*b*)	£3 8 0 (*a*) £3 12 0 (*b*)	£1 9 10 (*a*) £1 11 7 (*b*)
	D.2394G and D.2395G	Wall mounting	1 or 2 kW	One or two 1 kW bar	Beige vitreous enamel	£3 10 0 (D.2394G) £4 15 0 (D.2395G)	£1 10 9 (D.2394G) £2 1 8 (D.2395G)
	D.2496G and D.2497G	Portable firebar	1 or 2 kW	One or two 1 kW bar	Bronze, cream or green	£1 16 6 (D.2496G) £2 15 0 (D.2497G)	£0 16 0 (D.2496G) £1 4 2 (D.2497G)
	D.2757	Pedestal bowl	750 W	One 750 W spiral	Cream	£1 17 6	£0 16 5
	D.2766 and D.2767	Portable or wall mounting reflector	1 or 2 kW	One or two 1 kW rod	Cream	£3 5 6 (D.2766) £4 3 0 (D.2767)	£1 8 9 (D.2766) £1 16 5 (D.2767)
	D.2768	High level, wall mounting	1 kW	One 1 kW rod	Cream	£2 15 6	£1 4 4
	"Cosyglo" D.2812 and D.2813	Portable reflector	2 kW	Two 1 kW rod	Cream or silver bronze (*a*) or green or silver bronze (*b*)	£4 18 6 (*a*) £5 15 0 (*b*)	£2 3 3 (*a*) £2 10 5 (*b*)
	"Cosyglo" D.2814	Screen reflector	2 kW	Two 1 kW rod	Hammered bronze	£11 10 0	£5 0 11
	"Cosyglo" D.2815	Portable reflector, pedestal	2 kW	Two 1 kW rod	Moonstone grey, black base, with yellow relief	£4 18 6	£2 3 3
	D.2773 and D.2774	Portable reflector	1 or 2 kW	One or two 1 kW rod	Cream or silver bronze	£2 15 0 (D.2773) £3 12 6 (D.2774)	£1 4 2 (D.2773) £1 11 10 (D.2774)
	D.2775	Portable reflector	2 kW	Two 1 kW rod	Moonstone grey and burgundy with black legs	£4 16 0	£2 2 1
	"Cosyglo" D.2852G	Inset	2 kW	Two 1 kW rod	Bronze (*a*) or hammered bronze (*b*)	£5 11 6 (*a*) £5 16 0 (*b*)	£2 8 11 (*a*) £2 10 11 (*b*)
	"Cosyglo" D.2853	Wall mounting	2 kW	Two 1 kW rod	Cream or hammered bronze	£6 8 0	£2 16 2
GRAFTON HEATER CO., LTD., 13-15, Westland Place, London, N.1.	"Grafton"	Portable reflector, coal effect	750 W	One 750 W rod	Various colours	£2 13 6	£1 3 8
	"Grafton"	Portable reflector, coal effect	2 kW	Two 1 kW rod	Various colours	£6 6 0	£2 15 3
	9	Reflector	2 kW	Two 1 kW rod	Cream enamel	£3 0 0	£1 6 4
	106/36	Bowl	600 W	One 600 W E.S.	Various colours	£1 10 0	£0 13 2
GRUBB ENGINEERING CO., LTD., Mary Street, Balsall Heath, Birmingham, 12.	"Grubb"	Portable reflector	1 or 2 kW	One or two 1 kW rod	Cream, eau-de-nil, silver or gilt	£2 17 6 (1 kW) £3 7 6 (2 kW)	£1 5 2 (1 kW) £1 9 7 (2 kW)
L. G. HAWKINS & CO., LTD., 30-35, Drury Lane, London, W.C.2.	"Boomerang" LGH.339 and LGH.340	Portable reflector	1 or 2 kW	One or two 1 kW rod	Brown, mushroom and cream	£2 15 0 (339) £3 9 0 (340)	£1 4 2 (339) £1 10 3 (340)
	"Three-way" LGH.336	Portable reflector	1 kW	One 1 kW rod	Brown, mushroom and cream	£1 12 6	£0 14 3
	"Pixie" LGH.31	Portable reflector	1 kW	One 1 kW rod	Mushroom, silver or cream	£1 18 7	£0 16 11
	"Marilyn" LGH.34 and LGH.35	Portable reflector	1 or 2 kW	One or two 1 kW rod	Ivory, silver or mushroom	£2 3 11 (34) £3 5 7 (35)	£0 19 3 (34) £1 8 9 (35)
	"Loughton" LGH.337 and LGH.338	Pedestal reflector	1 or 2 kW	One or two 1 kW rod	Maroon and dove grey and all-cream	£2 19 0 (337) £3 12 11 (338)	£1 5 11 (337) £1 12 0 (338)
HEATRAE, LTD., Heatrae Works, Norwich.	"Saferod"	Reflector, wall mounting	1 kW	One 1 kW rod	Mushroom and chromium	£4 5 0	£1 17 4

Manufacturer	Name or Model	Type	Total Loading	Elements	Finish	Price (excl. Tax)	Purchase Tax
HEATRAE, LTD., Heatrae Works, Norwich. *(continued)*	" Pilot "	Portable reflector	1 kW	One 1 kW rod	Ivory tan	£4 5 0	£1 17 4
	" Dandy "	Portable reflector	2 kW	Two 1 kW rod	Ivory tan	£7 14 0	£3 7 6
H.M.V. HOUSEHOLD APPLIANCES, Hayes, Middlesex.	" Lincoln " F3 and 2/F3	Multi-parabola reflector	2 or 3 kW	Two 1 or 1½ kW rod	Maroon or rifle green, grey hammer base	£6 18 8	£3 0 10
	" Ely " F1	Multi-parabola reflector	1 kW	One 1 kW rod	Grey hammer base	£2 17 4	£1 5 2
HOTPOINT ELECTRIC APPLIANCE CO., LTD., Fletton, Peterborough.	HF.151	Portable reflector	1 kW	One 1 kW rod	Cream and chromium	£2 10 0	£1 2 0
	HF.152	Portable reflector	2 kW	Two 1 kW rod	Cream and chromium	£3 0 0	£1 6 4
	93	Portable radiant	2 kW	Two 1 kW bar	Mottled cream vitreous enamel	£4 0 0	£1 15 2
C. HOUNSLOW & CO., LTD., Chalex Works, Southwick, Sussex.	" Angular " 3007	Wall mounting reflector	1 kW	One 1 kW rod	Cream	£2 12 6	£1 3 2
	" Albemarle " 3008	Portable, imitation coal effect	2 kW	Two 1 kW rod	Gold, flecked cream	£7 0 2	£3 1 10
	" Vertic " 3005 and 3006	Portable reflector	1 or 2 kW	One or two 1 kW rod	Pastel cream and grey copper	£1 12 7 (3005) £2 12 6 (3006)	£0 14 5 (3005) £1 3 2 (3006)
	" Standard " 3001 and 3002	Portable firebar	1 or 2 kW	One or two 1 kW bar	Copper bronze	£1 12 7 (3001) £2 11 9 (3002)	£0 14 5 (3001) £1 2 10 (3002)
	" Standard " 3003 and 3004	Portable reflector	1 or 2 kW	One or two 1 kW rod	Copper bronze	£2 1 6 (3003) £3 1 5 (3004)	£0 18 4 (3003) £1 7 1 (3004)
JACKSON ELECTRIC STOVE CO., LTD., 143, Sloane Street, London, S.W.1.	251J	Inset reflector	2 kW	Two 1 kW rod	Chromium	£4 10 0	£1 19 6
	253J	Portable reflector	2 kW	Two 1 kW rod	Chromium	£4 17 6	£2 2 10
	731J and 732J	Portable reflector	1 or 2 kW	One or two 1 kW rod	Golden russet	£2 12 6 (731J) £3 10 0 (732J)	£1 3 1 (731J) £1 10 8 (732J)



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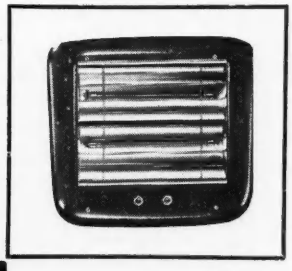

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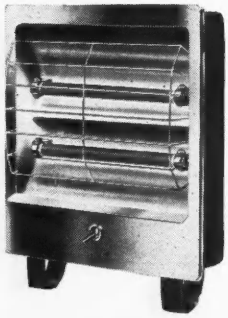

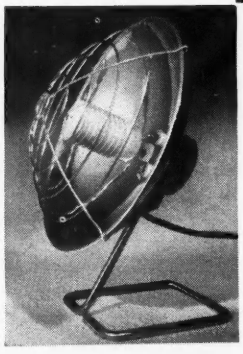

32. *Jackson 253J*
33. *Jackson 732J*
34. *Metway "Mirrorway"*
35. *M.E.M. "Walray"*

Manufacturer	Name or Model	Type	Total Loading	Elements	Finish	Price (excl. Tax)	Purchase Tax
MARSDEN & BATESON, LTD., 67-69, Scholefield Street, Nechells, Birmingham, 7.	" Marbat " 1 and 2	Inset firebar	1 or 2 kW	One or two 1 kW bar	Hammered bronze or silver	£1 19 0 (1) £3 0 0 (2)	£0 17 3 (1) £1 6 7 (2)
	" Marbat " 3 and 4	Wall panel, firebar	1 or 2 kW	One or two 1 kW bar	Hammered bronze or silver	£2 4 9 (3) £3 8 9 (4)	£0 19 10 (3) £1 10 5 (4)
	" Marbat " bowl	Portable or wall mounting	600 W	One 600 W spiral	Copper (*a*) or aluminium (*b*)	£2 5 0 (*a*) £1 18 6 (*b*)	£0 19 11 (*a*) £0 17 0 (*b*)
METWAY ELECTRICAL INDUSTRIES, LTD., Canning Street, Kemp Town, Brighton, 7.	" Minorway "	Small portable reflector	750 W	One 750 W rod	Mottled silver	£1 6 9	£0 11 6
	" Cradleway "	Small portable reflector	1 kW	One 1 kW rod	Mottled silver, chromium stand	£1 10 9	£0 13 4
	" Magnaway " one and two	Portable reflector	1 or 2 kW	One or two 1 kW rod	Mottled silver and chromium	£2 9 6 (one) £3 1 0 (two)	£1 1 5 (one) £1 6 5 (two)
	" Mirrorway "	Portable bowl	750 W	One 750 W spiral	Plain aluminium	£1 1 9	£0 9 5
	" Marvelway "	Portable bowl	1 kW	One 1 kW spiral	Fluted aluminium	£1 13 3	£0 14 5
MIDLAND ELECTRIC MFG. CO., LTD., M.E.M. Works, Reddings Lane, Birmingham, 11.	" Memray "	Portable, swivelled reflector	1 or 2 kW	One or two 1 kW rod	Bronze or cream	£2 17 4 (1 kW) £4 7 4 (2 kW)	£1 5 2 (1 kW) £1 18 4 (2 kW)
	" Reflex "	Portable, fixed reflector	1 or 2 kW	One or two 1 kW rod	Mushroom or mottled stone	£2 14 0 (1 kW) £4 3 0 (2 kW)	£1 3 8 (1 kW) £1 16 5 (2 kW)
	" Memglo "	Portable flat bar	1 or 2 kW	One or two 1 kW bar	Mottled stone	£2 2 0 (1 kW) £3 0 0 (2 kW)	£0 18 5 (1 kW) £1 6 4 (2 kW)
	" Walray "	Inset reflector	2 kW	Two 1 kW rod	Mushroom or mottled stone	£7 0 0	£3 1 5
	" Walbeam "	Outset flat bar	1 or 2 kW	One or two 1 kW bar	Mushroom or mottled stone	£2 19 8 (1 kW) £4 15 0 (2 kW)	£1 6 2 (1 kW) £2 1 8 (2 kW)
MONARCH ELECTRIC, LTD., Vicarage Road, Lye, Worcs.	" Doric " 501	Portable firebar	1 kW	One 1 kW bar	Dimenso enamel	£1 11 6	£0 13 10
	" Doric " 502	Portable firebar	2 kW	Two 1 kW bar	Dimenso enamel	£2 8 0	£1 1 1

36. *H.M.V. " Lincoln "*
37. *H.M.V. " Ely "*
38. *M.E.M. " Memray "*
39. *Metway " Cradleway "*
40. *Hotpoint HF.152*

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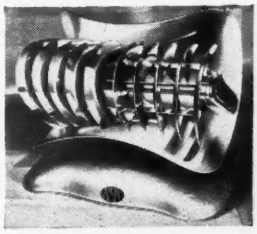

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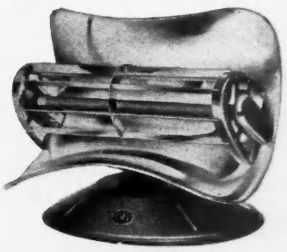

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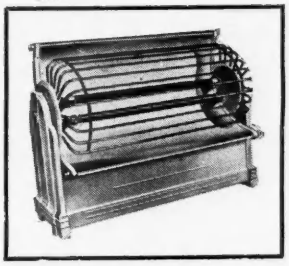

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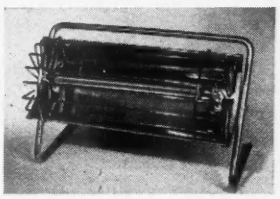

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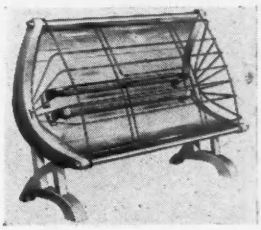

Manufacturer	Name or Model	Type	Total Loading	Elements	Finish	Price (excl. Tax)	Purchase Tax
T. B. MORLEY & CO., LTD., Jameson Street, Hull.	" Don "	Portable reflector	750 W to 2 kW	One or two 750 W or 1 kW rod	Cream	£2 11 0 (750 W) £2 14 0 (1 kW) £3 3 0 (1½ kW) £3 9 0 (2 kW)	£1 2 5 (750 W) £1 3 9 (1 kW) £1 7 9 (1½ kW) £1 10 5 (2 kW)
	" Humber "	Portable reflector	750 W or 1,500 W	One or two 750 W rod	Cream	£2 12 0 (750 W) £3 3 0 (1½ kW)	£1 2 11 (750 W) £1 7 9 (1½ kW)
	" Derwent "	Portable reflector	1 or 2 kW	One or two 1 kW rod	Cream	£2 13 0 (1 kW) £3 8 0 (2 kW)	£1 3 4 (1 kW) £1 9 11 (2 kW)
	" Thames "	Portable twin reflector	750 W or 1,500 W	One or two 750 W rod	Bronze	£1 14 6 (750 W) £2 12 6 (1½ kW)	£0 15 2 (750 W) £1 3 1 (1½ kW)
	" Severn "	Portable firebar	1 or 2 kW	One or two 1 kW bar	Bronze	£1 13 0 (1 kW) £2 10 0 (2 kW)	£0 14 6 (1 kW) £1 2 0 (2 kW)
	" Aire "	Portable reflector	1 or 2 kW	One or two 1 kW rod	Cream	£2 12 0 (1 kW) £3 7 0 (2 kW)	£1 2 11 (1 kW) £1 9 6 (2 kW)
	" Morco " bowl	Portable reflector	600 W	One 600 W spiral	Cream	£1 8 6	£0 12 6
MORPHY-RICHARDS, LTD., 6, Conduit Street, London, W.1.	" Avon " FA/10 and FA/20	Portable reflector	1 kW (FA/10) and 2 kW (FA/20)	One or two 1 kW rod	Beige	£3 10 0 (FA/10) £4 5 0 (FA/20)	£1 10 4 (FA/10) £1 16 10 (FA/20)
	" Cray " FC/750 and FC/15	Portable reflector	750 W (FC/750) and 1½ kW (FC/15)	One or two 750 W rod	Beige	£2 2 0 (FC/750) £2 12 6 (FC/15)	£0 18 3 (FC/750) £1 2 9 (FC/15)
	"Crav" FC/10 and FC/20	Portable reflector	1 kW (FC/10) and 2 kW (FC/20)	One or two 1 kW rod	Beige	£2 6 6 (FC/10) £2 17 6 (FC/20)	£1 0 2 (FC/10) £1 4 11 (FC/20)
PIFCO, LTD., 36-37, Upper Thames Street, London, E.C.4.	" Sheridan " 491	Portable reflector	1 kW	One 1 kW rod	Hammered silver grey or gold	£1 18 7	£0 16 11
PREMIER ELECTRIC HEATERS, Keeley Street, Birmingham, 9.	" Parabain " 5321	Wall mounting reflector	1 kW	One 1 kW rod	Ivory	£3 9 6	£1 10 6
	" Paraglow " 5380/1 and 5390/1	Portable reflector	1 or 2 kW	One or two 1 kW rod	Cream and bronze	£2 5 0 (5380/1) £2 15 0 (5390/1)	£0 19 10 (5380/1) £1 4 2 (5390/1)
	" Jewel " 5510/1 and 5520	Portable reflector	1 or 2 kW	One or two 1 kW rod	Green and cream (5510/1) Green (5520)	£1 17 6 (5510/1) £4 10 0 (5520)	£0 16 6 (5510/1) £1 19 6 (5520)
	" Parabeau " 5472G	Portable reflector	2 kW	Two 1 kW rod	Gilt	£5 15 0	£2 10 6

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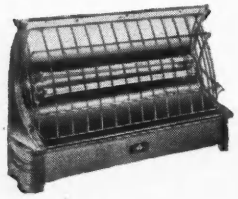

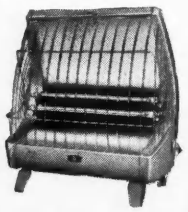

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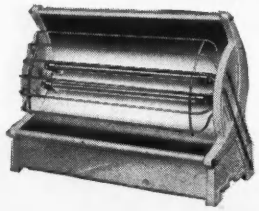

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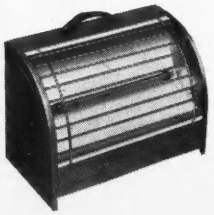

41. *Morphy-Richards FC/20 " Cray "*

42. *Morphy-Richards FA/20 " Avon "*

43. *Premier " Hystan "*

44. *T. B. Morley & Co.'s " Don "*

45. *Pifco " Sheridan "*

Manufacturer	Name or Model	Type	Total Loading	Elements	Finish	Price (excl. Tax)	Purchase Tax
PREMIER ELECTRIC HEATERS, Keeley Street, Birmingham, 9. *(continued)*	" Guardian " 5401, 5402 and 5403	Portable reflector	2 kW	Two 1 kW rod	Gold (5401) Pink (5402) Blue (5403)	£6 0 0	£2 12 8
	" Carlton " 5141, 5142 and 5143	Reflector imitation coal effect	2 kW	Two 1 kW rod	Silver (5141) Copper (5142) Gold (5143)	£12 0 0	£5 5 4
	" Screen Heater "	Radiant heater	1 kW	One 1 kW fused on glass	White and cream	£10 10 0	£4 12 2
	" Hystan " 5500	Portable reflector	2 kW	Two 1 kW rod	Cream, maroon feet	£4 15 0	£2 1 9
T. PRICE & SON (STAMPERS), LTD., Spring Hill Passage, Birmingham, 18.	2128	Imitation coal effect, grate fitting	2 kW	Two 1 kW rod	Cream	£5 10 0	£2 8 3
	2121	Imitation coal effect	2 kW	Two 1 kW rod	Cream	£6 5 0	£2 14 10
	2107	Imitation coal effect	1 kW	One 1 kW rod	Bronze	£2 5 0	£0 19 9
	2127	Portable reflector	2 kW	Two 1 kW rod	Cream	£2 10 0	£1 2 0
	2122	Portable reflector	750 W	One 750 W rod	Grey or maroon	£0 17 6	£0 7 9
	2133	Portable reflector	750 W	One 750 W rod	Cream, nickel (*a*) or chromium (*b*) reflector	£1 3 0 (*a*) £1 5 0 (*b*)	£0 10 1 (*a*) £0 11 0 (*b*)
	2136 and 2137	Portable reflector	1 or 1½ kW	One 1 kW rod (2136) or two ¾ kW rod (2137)	Cream	£1 6 9 (2136) £1 19 6 (2137)	£0 11 9 (2136) £0 17 4 (2137)
	2061	Wall mounting	1 kW	One 1 kW rod	Black and cream	£2 8 0	£1 1 1
	1657	Screen	750 W	One 750 W rod	Cream and gold or grey and maroon	£1 3 9	£0 10 6
REEVES ELECTRICAL AND RADIO CO., LTD., Reelek Works, Baldock, Herts.	" Regal "	Portable reflector	750 W and 1 kW	One 750 W rod or one 1 kW rod	Cream, silver grey, mushroom, green and blue	£1 0 0	£0 8 9
	" Popular "	Portable reflector	750 W and 1½ kW	One or two 750 W rod	Cream, silver grey, mushroom, green and blue	£1 5 0 (750 W) £1 15 0 (1½ kW)	£0 11 0 (750 W) £0 15 4 (1½ kW)
	" Minor "	Portable reflector	1 kW	One 1 kW rod	Cream, silver grey, mushroom, green and blue	£1 12 0	£0 14 0
	" Handy "	Portable reflector	1 or 2 kW	One or two 1 kW rod	Cream, silver grey, mushroom, green and blue	£1 10 0 (1 kW) £2 5 0 (2 kW)	£0 13 2 (1 kW) £0 19 8 (2 kW)
	" Wizard "	Portable reflector	1 or 2 kW	One or two 1 kW rod	Cream, silver grey, mushroom, green and blue	£2 0 0 (1 kW) £2 10 0 (2 kW)	£0 17 7 (1 kW) £1 2 0 (2 kW)
	" Adjustable "	Portable reflector	1 or 2 kW	One or two 1 kW rod	Cream, silver grey, mushroom, green and blue	£2 5 0 (1 kW) £2 15 0 (2 kW)	£0 19 8 (1 kW) £1 4 2 (2 kW)
REVO ELECTRIC CO., LTD., Tipton, Staffs.	" Reflexam " F.14546 and F.14548	Wall mounting reflector	1 or 2 kW	One or two 1 kW rod	Artshade silver and chromium	£3 10 6 (F.14546) £4 15 6 (F.14548)	£1 11 0 (F.14546) £2 2 0 (F.14548)
	" Dolphin " F.13950 and F.13948	Portable firebar	1 or 2 kW	One or two 1 kW bar	Beige	£2 19 0 (F.13950) £4 7 6 (F.13948)	£1 5 11 (F.13950) £1 18 5 (F.13948)
	" Revo-Inset " F.13955 and F.13956	Inset with slabbing frame	1 or 2 kW	One or two 1 kW bar	Green, grey or beige	£2 8 6 (F.13955) £3 17 6 (F.13956)	£1 1 4 (F.13955) £1 14 0 (F.13956)
	" Revo-Inset " F.13957 and F.13958	Inset with slabbing frame	1 or 2 kW	One or two 1 kW rod	Green, grey or beige	£2 8 6 (F.13957) £3 17 6 (F.13958)	£1 1 4 (F.13957) £1 14 0 (F.13958)
	" Revo-Outset " F.14639 and F.14640	Direct wall mounting	1 or 2 kW	One or two 1 kW bar	Green, grey or beige	£2 19 0 (F.14639) £4 5 0 (F.14640)	£1 5 11 (F.14639) £1 17 3 (F.14640)
	" Revo-Outset " F.14549 and F.14550	Direct wall mounting	1 or 2 kW	One or two 1 kW rod	Green, grey or beige	£3 4 0 (F.14549) £4 10 0 (F.14550)	£1 8 1 (F.14549) £1 19 6 (F.14550)

Manufacturer	Name or Model	Type	Total Loading	Elements	Finish	Price (excl. Tax)	Purchase Tax
REVO ELECTRIC CO., LTD., Tipton, Staffs. *(continued)*	" Tubula " F.14542 and F.14544	Portable reflector	1 or 2 kW	One or two 1 kW rod	Artshade silver and chromium	£3 7 6 (F.14542) £4 10 0 (F.14544)	£1 9 7 (F.14542) £1 19 6 (F.14544)
ROBIN HOOD ELECTRICAL CO., 646-8, Coventry Road, Small Heath, Birmingham, 10.	" Maid Marion "	Portable reflector	1 kW	One 1 kW rod	Hammered gold, nickel plated reflector	£2 13 8	£1 3 6
	" Friar Tuck "	Portable reflector	2 kW	Two 1 kW rod	Hammered gold, chromium reflector	£3 12 0	£1 11 7
	" Sherwood "	Portable reflector	2 kW	Two 1 kW rod	Hammered gold, chromium reflector	£4 8 5	£1 18 10
SELEX ELECTRIC CO. (KIRKBY), LTD., Yardley Road, Kirkby Industrial Estate, Liverpool.	1018 and 1019	Portable reflector	1 or 2 kW	One or two 1 kW 10in rod	Golden bronze	£2 10 0 (1018) £3 3 0 (1019)	£1 2 0 (1018) £1 7 9 (1019)
	1020	Portable reflector	2 kW	Two 1 kW 13in rod	Silver	£3 17 9	£1 15 0
TELSEN ELECTRIC CO. (1935), LTD., Fitzgeorge Street, Collyhurst, Manchester, 9.	1200 and 1205	Portable reflector	1 or 2 kW	One or two 1 kW rod	Vitreous enamel sides, plated reflector	£1 13 4 (1200) £2 13 4 (1205)	£0 13 6 (1200) £1 2 6 (1205)
	1175	Imitation coal	2 kW	Two 1 kW rod	Hammered, in variety of colours	£7 10 0	£3 7 6
TYM'S ELECTRIC, Systym Works, Kennard Road, Stratford, E.15.	" Sunglo "	Portable firebar	¾ or 1 kW	One ¾ or 1 kW bar	Hammered gold	£1 0 0	£0 7 0
	" Sunglo "	Portable firebar	1½ or 2 kW	Two ¾ or 1 kW bar	Hammered gold	£1 10 0	£0 10 6
	" Sunshine "	Portable reflector	¾ or 1 kW	One ¾ or 1 kW rod	Cream enamel	£1 5 10	£0 9 3
	" Sunshine "	Portable reflector	1½ or 2 kW	Two ¾ or 1 kW rod	Cream enamel	£1 12 6	£0 11 6
	" Domestic "	Portable reflector	1 kW	One 1 kW rod	Cream enamel	£1 0 0	£0 7 0
	" Contemporary "	Portable bowl	750 W	One 750 W spiral	Aluminium	£1 0 0	£0 7 0

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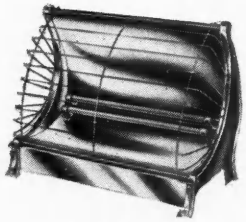
46. *Robin Hood Electrical Co.'s " Sherwood "*



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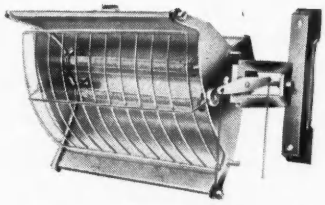
47. *Selex 1020*



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48. *Revo " Reflexam " wall mounting reflector*

CATALOGUES AND LISTS

BIN VIBRATORS.—Leaflets giving particulars of the company's standard range of bin vibrators and vibratory control gear.—**Magnetic Equipment Co., Ltd.,** Lake Works, Portchester, Hants.

CABLE.—Showcard with samples and full specifications of the range of coaxial television cables produced by the company.—**Aerialite, Ltd.,** Castle Works, Stalybridge, Cheshire.

CABLE TRUNKING.—Priced leaflet giving particulars of mild steel cable trunking produced by the company.—**H. W. Field & Son, Ltd.,** Harold Wood, Essex.

DOMESTIC APPLIANCES.—112-page illustrated and priced catalogue dealing with domestic appliances, space heating, water heating and ventilating equipment.—**London Electrical Co. (Blackfriars), Ltd.,** Blackfriars Road, London, S.E.1.

DRILLING MACHINES. — Technical Bulletin (No. 20) dealing with the company's rotary drilling machines for drilling rock for mining purposes, etc.—**Victor Products (Wallsend), Ltd.,** Wallsend-on-Tyne.

JOINT BOXES. — 10-page booklet (P.B.S/1) describing the " Telcon " PB type joint box for polythene insulated and sheathed cables and other types of cables employed in telephone and control circuits, etc.—**Telegraph Construction & Maintenance Co., Ltd.,** Telcon Works, Greenwich, S.E.10.

LIGHTING.—Binder designed to accommodate all the company's lamp and lighting catalogues and containing sections devoted to their range of lamps, fluorescent lighting and industrial lighting fittings, together with a separate loose-leaf catalogue of street lighting equipment.—**A.E.I. Lamp & Lighting Co., Ltd.,** Crown House, Aldwych, W.C.2.

32-page priced catalogue dealing with the company's range of tungsten filament, fluorescent and other lamps.—**Ekco-Ensign Electric, Ltd.,** 45, Essex Street, London, W.C.2.

Priced folder illustrating a new range of lighting fittings.—**Troughton & Young (Lighting), Ltd.,** 143, Knightsbridge, S.W.1.

Leaflets describing the " 555/SPD " plastics fluorescent lighting fitting for three 5ft 80 W lamps, and the " TX " range of fluorescent fittings.—**H. W. Field & Son, Ltd.,** Harold Wood, Essex.

GENERATION AND DEVELOPMENT

C.E.A. Contracts

Contracts have been placed by the Central Electricity Authority over the past two months for power stations, transforming stations and transmission lines, amounting in the aggregate to £11,117,150. The principal contracts include the following:—

Northfleet power station: Substructure, stage 2.—Taylor Woodrow Construction.

Poole power station: Superstructure for main and ancillary buildings.—James Drewitt & Son. Conversion of eight 340,000 lb/hr boilers to oil firing.—Associated British Construction.

Portishead "B" power station, near Bristol: Foundations to buildings, roads, railways, etc.—Chas. Brand & Sons. Conversion of eight 300,000 lb/hr boilers to oil firing.—Mitchell Engineering. Condensing and circulating water plant for one 60,000 kW set.—Metropolitan-Vickers Electrical Co.

South Denes power station, Yarmouth: Conversion to oil firing of two 550,000 lb/hr boilers.—International Combustion.

Tilbury power station: Conversion of six 540,000 lb/hr boilers to oil firing.—John Thompson Water Tube Boilers.

Drakelow power station, Burton-on-Trent: 275 kV switchgear.—A. Reyrolle & Co.

High Marnham power station, near Tuxford: Coal handling plant.—Mitchell Engineering, Ltd. 275 kV switchgear.—British Thomson-Houston Co.

Blyth "A" power station: 3,300 V switchgear and accessories:—A. Reyrolle & Co.

Ince power station, near Ellesmere Port: Two 45 MVA, 132/33 kV transformers.—Fuller Electrical & Manufacturing Co.

Dartford substation: Four 45 MVA, 132/33 kV transformers.—Crompton Parkinson.

Luton, Alton and Reading substations: 132 kV switchgear.—A. Reyrolle & Co.

Harker substation: 132 kV switchgear.—Ferguson, Pailin.

Creyke Beck substation: 132 kV switchgear.—A. Reyrolle & Co. 132 kV overhead line.—Pirelli-General Cable Works.

Windscale and Calder: 132 kV switchgear.—Metropolitan-Vickers Electrical Co.

Paignton substation: 132 kV switchgear.—British Thomson-Houston Co.

Carrington and Staythorpe substations: 275 kV switchgear.—Metropolitan-Vickers Electrical Co.

Connah's Quay "B" substation: 275 kV switchgear.—English Electric Co.

Capenhurst substation: 132 kV switchgear.—English Electric Co.

Basildon substation: Two 60 MVA, 132/33 kV transformers.—Metropolitan-Vickers Electrical Co.

Spadenham substation: Two 30 MVA, 132/11 kV transformers.—Crompton Parkinson.

Ellesmere Port substation: One 45 MVA, 132/33 kV transformer.—C. A. Parsons.

Tilbury-Rayleigh: 275 kV overhead line.—W. T. Henley's Telegraph Works Co.

Fleet-Pyestock: 132 kV and 33 kV cables.—Pirelli-General Cable Works.

Paignton-Plymouth/Newton Abbot: 132 kV overhead line: Pirelli-General Cable Works.

Crewe-Legacy and Husthwaite-Wormald Green: 132 kV pole lines.—Riley & Neate.

Poole-Yeovil and Poole-Shaftesbury: 132 kV overhead line.—Riley & Neate.

Progress in North Eastern Area

Mr. T. M. Ayres, chairman of the North Eastern Electricity Board, in a Press statement following the publication of the Board's annual report, said that it was expected that within five years 85 per cent of the farms in the Board's area would be supplied with electricity. The work of taking over networks hitherto controlled by the National Coal Board would be completed in 1957. Mr. Ayres commented that with the commissioning of bulk supply points at Seaton Burn, near Newcastle-on-Tyne, and at Norton, in North Yorkshire, the North-East was not likely to suffer a major breakdown in supplies as occurred last December. On that occasion a large part of the Area was without electricity for several hours owing to a breakdown at the Stella power station.

Scottish Nuclear Power Station Site

The Hunterston Estate near West Kilbride, on the Ayrshire coast, has been selected by the South of Scotland Electricity Board as the proposed site for its nuclear generating station. The Board announced earlier its intention to build such a station, at a cost of approximately £35 million, and indicated then that a site on the Ayrshire coast might be chosen.

The station will be situated on the shores of the Clyde approaches in an area scheduled under the Clyde Valley plan for a holiday town and some opposition is anticipated. The site has not yet been finally decided but Hunterston combines all the natural requirements for such a station with close proximity to the Board's load centres in the Central West Area. Because of the special considerations involved, the application is being made direct to the Secretary of State for Scotland in place of the more normal routine for approval by the Ayrshire County Planning Authority. The proposed station will contain two nuclear reactors capable of providing sufficient heat to generate from 250,000 to 300,000 kW. The Board plans to bring the first reactor into use in 1961 and the second in 1962.

Grain Drying Tariff

The North of Scotland Hydro-Electric Board has agreed to offer special rates for electricity for grain drying purposes and will co-operate with the National Farmers' Union in putting this plan into effect. The Inverness-shire Area Committee of the N.F.U. has been pressing for such facilities and has now secured the Board's approval of a special tariff for grain dryers between 1st May and 31st October and between 7 p.m. and 7 a.m. from 1st November to 30th April. Special metering will be used to record consumption. Local arrangements are in the hands of the Inverness Sub-Area office of the Board.

Meter Reading Economy

When a meter reader calls and finds no one at home it is common practice for him to leave a card on which the householder records the consumption, the meter reader checking and adjusting at the next reading. The South of Scotland Electricity Board is carrying out an experimental extension of this procedure as an economy measure. In Kirkcaldy the summer accounts of a number of consumers have been based on the previous year's consumption, the amount being adjusted at the subsequent reading. Some consumers have objected but the number has been very much smaller than anticipated. In these cases readings have been taken. The system is now being tried out in Edinburgh where 25 per cent of the current quarter's accounts will be based on the consumption in the same quarter of last year.

Renaming of Scottish Area

The South of Scotland Electricity Board has renamed its Central Area, with headquarters at "Woodlands," St. Ninian's Road, Stirling, as the "Stirling Area." The names of all the Board's administrative areas are now descriptive of the localities which they serve.

Higher Charges?

Commenting on the Yorkshire Electricity Board's deficit of £77,733 in the last financial year, the third incurred in eight years, Mr. Dennis Bellamy, the chairman, said at a Press conference at Leeds last week that electricity in Yorkshire was the second cheapest in the country and administration and general expenses were the lowest of any Area Board. The deficit represented one-fifth of 1 per cent of the total turnover of £38,500,000. Owing to the temporary "price freeze" under the Government's policy, however, there would be a substantial deficit in 1956-57 and the position was very serious. Higher tariffs to operate in the next financial year would be placed before the Consultative Council in December. Mr. Bellamy also said that the restrictions on capital expenditure might affect the security and quality of supplies, a risk of which the Government had been made fully aware.

Colwyn Bay Housing Policy

The Merseyside and North Wales Electricity Board complains that as a result of Colwyn Bay Council's policy tenants have no freedom of choice between gas and electricity for cooking on the Elwy Road housing estate at Rhos-on-Sea. The Board has incurred considerable expense in providing substations and an underground distribution system on the estate, but the Council's policy has been to install gas cookers and wash boilers throughout the estate. The Council has decided to invite the Board to send a representative to discuss the matter.

Financial Section

STOCKS and SHARES

WHILE awaiting the next stage in the development of the Suez problem, interest in the Stock Exchange has been taking notice of the extent to which the profit margins of industry are being squeezed between the rise in wages and other costs and the effort to hold down selling prices. This matter was brought to the fore last month by the half-yearly statement from Associated Electrical Industries, with its disclosure of a 20 per cent fall in the net trading profit (before tax) despite an increase in turnover, as compared with the first half of last year. At the General Electric Company's annual meeting, Sir Harry Railing spoke seriously of the reduction in profit margins as it affects the ability of industry to keep up an adequate rate of savings and investment.

G.E.C. Capital

Allotment letters and application forms were due to go out in the early part of this week to the General Electric Company's stockholders in connection with the issue of £6 million 6 per cent unsecured loan stock and 4,285,320 new £1 ordinary shares. The former is being offered at par to all classes of stockholders; the latter to ordinary stockholders at a price of £2 per share, in the proportion of three new shares for every £10 of stock held. The combined operation will produce about £14¼ million of new money, for use largely in providing for increased production of capital goods for the major industries and for the construction of thermal and nuclear power plants.

New Ordinary Shares

G.E.C. ordinary shares were quoted in the market at 43s 3d (with the official quotation at 42s 6d) immediately in advance of the issue of new shares. As is often the case on these occasions, the price reflected a measure of uncertainty about the effect which might be produced temporarily by some selling of the "rights" in markets as unsettled as they are at present. Against this, however, the market expects to see a good demand for the shares from new investors, who have the opportunity in the early stages to acquire them free of transfer stamp duty and with an attractive yield in prospect. In the first announcement of the issue there was no mention of dividend prospects on the larger capital, but taking into account the good cover for this year's distribution, and the benefits to come from the employment of the extra capital, expectations are based tentatively on the maintenance of the rate at 14 per cent. This would produce a yield of 7 per cent for present stockholders who exercise their rights, and a return in the neighbourhood of 6¾ per cent to a buyer of the new shares at a moderate premium on the issue price.

Price Changes

A generally dull tone persisted among the group of leading shares in the electrical equipment market, despite

Price Changes in

Company or Board	Nom. Value	Middle price 1st Oct.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1956 Highest	1956 Lowest
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	73⅛		3	3	4 1 9	80⅛	73⅛
Brit. Elec. 1974/77	100	72½	+1	3	3	4 2 9	79⅛	71⅛
Brit. Elec. 1976/79	100	77⅛		3½	3½	4 10 3	84	77⅛
Brit. Elec. 1974/79	100	86½		4¼	4¼	4 18 3	95	86½
Overseas Electric Supply								
Calcutta Elec.	£1	19/3		6†	6†	6 4 9†	20/9	19/-
East African Power	£1	19/6		7	7	7 3 6	21/3	19/6
Nigerian Elec.	£1	17/6		10	10*	11 8 6	21/-	17/-
Perak Hydro-Elec.	£1	16/6	+6d	10	10	—	17/6	14/9
Equipment and Manufacturing								
Aberdare Cables	5/-	12/-		17½	17½	7 5 9	13/6	10/6
Aerialite	1/-	5/-	+3d	88⅛	45*	9 0 0	6/9	4/9
Allen, W. H.	£1	38/9		20	10*	5 3 3	39/-	33/6
Aron Elec. Ord.	£1	55/9		15	15	5 7 6	56/-	53/6
Assd. Automation	10/-	18/-		10	5	2 15 6	19/-	17/-
Assoc. Elec. Ord.	£1	62/6	−2/6	14	15	4 16 0	85/6	57/9
Automatic Tel. & El.	£1	58/9		15	15	5 2 3	72/6	56/3
Babcock & Wilcox	£1	77/6	−2/-	15	15	3 17 6	85/6	64/-
Baldwin, H. J.	2/-	5/-		20	20	8 0 0	5/-	3/9
Bakelite	10/-	26/6	−1/-	16	16	6 0 9	34/-	26/6
Berry's Electric	5/-	6/-		—	10‡	8 6 9	6/6	5/9
British Aluminium	£1	67/6	−3/9	12	12	3 11 3	78/9	40/6
B.I. Callender's	£1	49/6		10	12½	5 1 0	54/3	45/-
B.I. Callender's 6% Pref.	£1	21/9		6	6	5 10 3	22/6	20/3
British Tabulating	£1	50/-		9	9	3 12 0	51/3	37/3
British Thermostat	5/-	26/3		20	25	4 15 3	31/9	24/6
British Vac. Cleaner	5/-	8/-		30	15*	9 7 6	8/9	6/-
Brook Motors	10/-	33/9		20	25	7 8 3	44/-	31/9
Brush Group	5/-	6/-		10	10	8 6 9	7/9	5/9
Bulgin, A. F.	1/-	4/9		45	50	—	5/3	4/3
Burco Dean	5/-	8/6		—	22½	13 4 9	13/6	8/3
Chloride El. Storage "A"	£1	62/6		17½	17½	5 12 0	73/6	60/9
Clarke Chapman	£1	120/-		20	22½	3 15 0	123/-	89/6
Cole, E. K.	5/-	17/3	−3d	17½	17½	5 1 6	22/3	15/6
Cossor, A. C.	5/-	5/6	−6d	15	Nil	Nil	10/3	5/-
Crabtree	10/-	24/6		20	20	8 3 3	29/3	24/6
Crompton Parkinson Ord.	5/-	13/3		20	16*	6 0 9	15/-	12/3
De La Rue	5/-	16/9		30	30	8 19 0	20/3	15/-
Decca "A"	4/-	26/3		56¼	43¾*	6 13 3	44/9	24/9
Desoutter	5/-	31/-		25	30	4 16 9	32/9	25/9
Dewhurst	2/-	6/-		24	30	—	7/6	5/3
Dictograph Tel.	2/-	5/9		20	20	6 19 3	6/9	5/6
Dubilier Condenser	1/-	4/6		25	30	6 13 3	4/9	3/6
Duport	5/-	18/9		23	25‡	6 13 3	21/6	13/9
E.M.I.	10/-	27/-	−1/-	10	15	5 11 0	37/-	25/6
Electrical Components	5/-	15/-		25	25	8 6 9	16/-	12/6
Elec. Construction	£1	23/9		8½	8½	7 2 3	29/9	23/9
Elliott Bros.	5/-	28/9	−3/9	19	17½*	3 0 9	36/9	24/6
Enfield Cable Ord.	£1	14/3		Nil	Nil	Nil	19/3	13/6
English Electric	£1	46/3	−1/3	12½	12½	5 8 0	66/3	46/3
English Electric 3¾% Pref.	£1	13/-		3¾	3¾	5 15 6	14/6	12/6
Ericsson Tel.	5/-	38/-		20†	20†	2 12 9†	42/9	33/6
Ever Ready	5/-	28/6	+3d	35	35	6 2 9	32/9	24/-
Falk Stadelmann	£1	36/9		15	17½	9 10 6	45/9	36/9
G.E.C. Ord.	£1	42/6	−2/6	12½	14	6 11 9	65/6	42/6
G.E.C. 6½% Pref.	£1	22/-	−3d	6½	6½	5 18 3	23/9	21/3
General Cables	5/-	12/3		30	30	12 5 0	13/9	11/3
Greenwood & Batley	£1	46/3		17½	17½	7 11 3	47/6	45/-
Hackbridge Holdings	5/-	22/3		25	30	6 14 9	24/6	18/9
Hackbridge & Hewittic	5/-	17/6	−1/3	30	23*	6 11 6	22/-	17/3
Heatrae	2/-	3/9		15	15	8 0 0	5/1	3/9
Henley's	10/-	16/3		10½	11½	7 1 6	19/9	14/-
Holophane	5/-	21/3		25	30	7 1 3	21/3	17/-

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend forecast.

the interest aroused by the first presentation of tenders to the Central Electricity Authority for atomic power station construction. A.E.I. went back half-a-crown further to 62s 6d, and are now 7s 6d below the price quoted before the issue of the half-year's progress report. English Electrics were again lower, by 1s 3d. Reyrolles lost 3s 6d, and Babcocks 2s. Declines of 1s or so were marked in Electric Construction, Hackbridge & Hewittic and Telegraph Condenser. Elsewhere I.C.I. were not greatly affected by the interim report. Murex again provided a cheerful feature, and Vactric and Watford Electric also continued upwards, while Morphy-Richards rose well in front of the dividend declaration.

Electrical Investments

Company or Board	Nom. Value	Middle price 1st Oct.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1956 Highest	1956 Lowest
Equipment and Manufacturing—continued						£ s d		
Hoover	5/-	23/-	−6d	70	50	10 17 6	39/3	23/-
I.C.I.	£1	42/6	−3d	10	10	4 14 3	49/9	41/3
Intl. Combustion	5/-	20/-		25	20*	5 0 0	25/-	15/3
Johnson & Phillips	£1	40/-	−9d	15	15	7 10 0	46/6	37/6
Lancashire Dynamo	£1	42/-		15	11*	5 4 9	49/9	40/9
Laurence, Scott	5/-	15/3		12½	15	4 18 3	16/9	13/3
Lister, R. A.	£1	30/-		9·3	10	6 13 3	35/3	27/6
London Elec. Wire	£1	46/3	−1/3	12½	12½	5 8 0	52/9	46/5
Lucas, J.	£1	31/3	−6d	7½	7½	4 16 0	40/3	29/6
Marryat & Scott	2/-	10/-		30	30	6 0 0	11/3	9/6
Mather & Platt	£1	55/6		15	15	5 8 0	65/3	51/6
Metal Industries	£1	21/-	+6d	9	9	—	27/-	16/3
Midland Elec. Mfg.	£1	45/-		10	12½	5 11 0	48/6	43/6
Morphy-Richards	4/-	25/-	+3/9	35	50	8 0 0	27/3	20/-
Murex	£1	73/9	+1/3	20	20	5 8 6	74/6	60/-
Newman Ind.	2/-	2/3		10	10	8 17 9	2/9	2/1
Oldham & Son	1/-	2/6		20	17½*	7 0 0	3/-	2/3
Parnall (Yate)	5/-	5/6		14	12	10 18 3	9/6	5/6
Parsons, C. A.	£1	90/-	+1/3	10	10	2 4 6	96/-	61/6
Plessey	10/-	72/-		27½	30‡	4 3 3	87/6	56/-
Pye "A" Deferred	5/-	16/3	−9d	12½	12½	3 17 0	21/3	14/-
Reyrolle	£1	111/3	−3/6	15	16½	2 18 6	117/6	81/-
Rheostatic	4/-	9/9		18½	12‡	4 19 0	—	8/3
Richardsons Westgarth	5/-	16/-		16⅔	16⅔	5 4 3	17/-	13/9
Scottish Cables	4/-	15/9		27½	27½	6 19 3	17/9	15/9
Smith (England), S.	4/-	11/-		17½	17½	6 7 3	14/3	10/6
Southern Areas	£1	16/3		10	7½	9 4 6	28/9	15/-
Strand Elec.	5/-	8/-		15	15	9 7 6	8/6	6/9
Sturtevant	5/-	24/3		14·4†	15†	3 1 9†	31/3	22/6
Sun Elec.	£1	38/9	+5/-	15	20	10 6 6	37/6	35/-
Switchgear & Cowans	5/-	14/-	+6d	20	25	8 18 6	17/-	13/6
Taylor Tunnicliff	5/-	11/9	+6d	15	15	6 7 9	14/-	11/3
T.C.C.	10/-	36/3	−1/3	25	25	6 18 6	45/-	36/3
T.C. & M.	£1	27/6		8½	8½	6 3 9	34/-	26/-
Telephone Mfg.	5/-	7/-		10	10*	7 2 9	8/6	6/3
Thorn Elec.	5/-	16/3		15	15	4 12 3	22/6	16/-
Thornycroft	£1	45/-		15	15*	6 13 3	49/9	41/3
Tube Investments	£1	57/-	−6d	22½	14*‡	4 18 3	70/6	54/9
Vactric	5/-	14/-	+6d	15	17½*	6 5 0	15/-	11/6
Veritys	5/-	9/-	+9d	12½	12½	6 19 0	10/-	6/9
Walsall Conduits	4/-	12/9	+3d	70	20*	6 5 6	13/6	10/9
Ward & Goldstone	5/-	39/6		30	35	4 8 6	39/6	29/-
Watford	2/-	7/-	+3d	25	25	7 2 9	7/6	6/-
Westinghouse	£1	72/6		18	18	4 19 3	100/-	71/6
West, Allen	5/-	12/6	−3d	15	15	6 0 0	14/6	11/6
Wolf Electric	5/-	17/6		20	20	5 14 3	26/3	17/6
Trusts, Transport and Communications								
Anglo-Portuguese	£1	21/9		8	8	7 7 0	23/6	20/3
British Elec. Traction: Def. Ord. "A"	5/-	18/-		22½	22½	6 5 0	20/-	15/6
Cable & Wireless: Ord.	5/-	10/6		10	10	4 15 3	11/3	9/6
4% Loan	100	90½		4	4	4 8 6	92½	88
Calcutta Trams	£1	26/3		6†	7½†	5 14 3†	27/6	23/-
Cape Elec. Trams	£1	16/3		8	8	9 17 0	20/3	18/-
Marconi Marine	£1	31/-		10	10	6 9 0	34/-	31/-
Oriental Tel. Ord.	1/-	72/6		16	—	—	90/-	67/6
Telephone Rentals	5/-	10/9		12½	12½	5 16 3	11/9	9/9

Merger Proposals

First reactions to news of the negotiations for a merger of interests between Elliott Brothers (London) and Associated Insulation Products took the form of a rise of 4s 6d in the latter company's shares, at 26s, while Elliotts went back from 31s 6d to 28s 9d. The proposal is for an exchange of A.I.P. shares for an equal number of Elliotts. Both are of 5s denomination. A further announcement is to be made when conditions have been agreed. Veritys 5s ordinary were marked up to 9s after the company's announcement that an offer had been received from the Limit Engineering Group to acquire them in exchange for the latter's 1s shares, in the proportion of four for each 5s Veritys unit. The board promised to make another announcement after consideration had been given to the proposal. Limit Engineering shares, which were introduced to the market about a year ago, have been quoted lately at 2s 7½d.

Switchgear and Cowans Issue

Switchgear & Cowans state their intention of making an issue of new ordinary shares, to which official authorisation has been given. The first announcement was made together with the declaration of a 10 per cent interim dividend on account of the current year. This represents a break with the usual practice, which is to make a single annual distribution about March. On the last occasion there was a payment of 25 per cent from earnings which were equivalent to 56 per cent on the then issued capital of £175,000, and were the best in the company's history. In the report, mention was made of the financial strain imposed by the increase in the group's activities. The shares have been dealt in at around 14s since news of the issue.

Autumn Dividends

This month usually sees the beginning of a small season of dividend declarations and profit statements from the companies which make up their accounts to the middle of the year. One of the most interesting announcements can be expected to come towards the end of the month from Crompton Parkinson, who closed their books in June. Results covering the same period will be due from Plessey a month or so later. This month's company news can also be expected to include final dividend declarations from Crabtree Electrical Industries, Tube Investments, Contactor Switchgear and Electrical Apparatus, for all of which the financial year ended in July. Annual results from Electric & Musical Industries, and the single dividend payment, are expected to be made known on Thursday week, the 18th.

REPORTS and DIVIDENDS

The General Electric Co., Ltd.—A record turnover and a record in exports were reported by Sir Harry Railing (chairman and joint managing director) in his address to shareholders at the annual meeting held on 27th September. Sir Harry said that the company had spent large sums on new plant and building and these assets had risen from £15·8 million to £18·5 million, to provide for an increased output, mainly of capital goods. The achievement of the highest turnover in the company's history was contributed to by all departments—heavy and light engineering, telecommunications and electronics and lamps and lighting. The only shrinkage of activity reported had taken place in the consumer goods division, where Government restrictions succeeded in curtailing demand. Sales of electrical consumer goods had now stabilised at lower levels. A new design centre had been established at Wembley to ensure the maintenance of leadership in this field. They considered it essential to continue their expansion in the capital goods field, and the proportion of their turnover in capital goods, compared with that in consumer goods, had steadily increased during the last two decades.

It was fully understood that the fight against inflation necessitated the tightening-up of credit conditions for certain consumer articles—especially for luxury goods. It must, however, be realised that many domestic electrical appliances, in fact, represented labour-saving devices which were indispensable to national efficiency. Adequate turnover for such appliances in the home market was the basis for export business. It was clear that the normal development of this market could only be kept back for a limited period. There had lately been signs of some improvement. Overseas in their principal markets such as Australia and New Zealand, much the same circumstances had interfered with their trading, while in Argentina and Pakistan the action of governments in depreciating the official rate of exchange had automatically called for the writing-down of their assets in those countries, and entailed a charge against their profits of some quarter of a million pounds.

Referring to last year's activities, Sir Harry said that work on crystal valves and semi-conductor power rectifiers had continued to occupy an important place in the research and development programme. New ground had been broken in the study of the scatter propagation of radio waves, in the investigation of electronic switching techniques for use in telephone exchanges and in the development of the advanced types of microwave valves. The design of the first nuclear power station, in accordance with the Government's programme for nuclear power, had been completed. In the atomic energy field they were associated with Simon-Carves, the Motherwell Bridge & Engineering Co., and John Mowlem & Co.

Some of the more important orders received and contracts completed during the year under review included 210 MW of steam turbo-generating equipment for the Central Electricity Authority, and a third 25 MW hydro-alternator for the North of Scotland Hydro-Electric Board. Overseas, sets totalling 140 MW had been installed in South Africa; two orders had been received from Australia for two 60 MW hydrogen-cooled turbo-alternators for the New South Wales Electricity Commission, and one 30 MW set for the Mount Isa Mines in Queensland. Designs for turbo-alternators up to 200 MW had been prepared and investigations continued on problems associated with generating equipment up to 300 MW using their patented direct-cooled rotor. Transformers totalling 290 MVA had been commissioned for the C.E.A. during the year. Many contracts were in hand for 132 kV and 270 kV outdoor and for large 33 kV metalclad switchgear. Among important contracts completed at home for materials handling and other equipment were coal preparation plants for the National Coal Board and a 200 ton/hr capacity limestone crushing and screening plant for Beswick's Lime Works. Abroad, they installed their first coal preparation plant in New South Wales. Marine electrical equipment supplied during the year included equipment for the *Bergensfjord*, the first a.c. passenger ship to be built in British shipyards. Orders received from the British Transport Commission for the modernisation of the railways included the supply of diesel-electric equipment for ten main line and ten branch line locomotives and forty-five power equipment units for diesel-electric shunting locomotives.

Their increasing contribution to telecommunications and electronics was shown in the opening of the new Portsmouth works and in the new joint venture with the British Tabulating Machine Co. for the development of electronic computers for use in automation, stock control and office machinery. The demand for "Osram" lamps continued to rise, both in the domestic and export markets, and the demand for street lighting equipment had been well maintained.

After briefly referring to the subsidiary and associated companies, Sir Harry turned to national and industrial matters. He observed that the United Kingdom's share of world electricity production had shown a small but steady decline—from 6·3 per cent in 1948 to 6 per cent in 1955. Electricity production rose by 74·1 per cent in the United Kingdom between 1948 and 1955, but the increase for Germany was 131 per cent, for the United States 85 per cent and total world production of electricity rose by 84 per cent.

In referring to the squeezing of profit margins, Sir Harry emphasised that they might possibly further decline.

If we were to stand up to competition from other nations we could not fight with antiquated weapons and for this reason automation was essential to maintain a reasonable living standard. The many human problems which were connected with industrial progress, like automation, must be resolved in joint consultation. Another round of wage increases, unaccompanied by corresponding increases in the volume of production, could not be contemplated.

Sir Harry concluded by referring to the company's decision, announced last week, to raise £14¼ million additional capital. He said this was required to finance the larger amount of stock and work-in-progress, arising from the increased business of the group at home and overseas, and to continue its modernisation and re-equipment plans.

James Howden & Co., Ltd.—The preliminary figures for the year ended 30th April last given in our issue of 21st September are now confirmed by the report and accounts now issued. In his statement to stockholders, Mr. C. W. Hume (chairman) says that sales have been well maintained and show no reduction on previous years and the order book shows an increase over the previous year. The companies in Australia and South Africa have had a successful year, and in Canada, where up to recently the power supply has been mainly provided by hydro-electric stations in which the company has little interest, it is now being found necessary and economical to build new thermal stations and the company has within the last year or so obtained important orders for its equipment. During the year under review a wholly owned Canadian subsidiary has been formed.

Bennis Combustion (Engineers), Ltd., report that after providing £26,650 for taxation, the net profit for the year to 30th April last is £23,586, as compared with £44,767 for the preceding year. It is proposed to pay a final dividend of 10 per cent, maintaining the distribution for the year at 15 per cent.

The George Cohen 600 Group, Ltd.—At an extraordinary general meeting, held on 25th September immediately following the annual general meeting, resolutions were passed having the following effects: a new subsidiary will take over the trading activities of the parent company and will adopt the

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FINANCIAL SECTION *(continued)*

name of the latter, i.e., George Cohen Sons & Co., Ltd.; the name of the parent company is changed to the George Cohen 600 Group, Ltd., this company becoming a holding company controlling the group. These changes are designed to simplify the group's administration and control.

Lightalloys, Ltd.—The accounts for the year ended 1st July last show a trading profit of £40,675, and after providing for depreciation, etc., and £14,565 for taxation, the net balance is £21,431 (against a deficit of £15,948). It is proposed to pay a dividend for the year of 10 per cent (against nil) and to carry forward £14,531.

Switchgear & Cowans, Ltd., have obtained Treasury consent for a rights issue of 5s ordinary shares. Details of the issue are to be announced.

Hilger & Watts, Ltd., are to make an issue of 300,000 5s ordinary shares at 8s 6d each. The shares will be offered by way of rights to ordinary shareholders on a one-for-three basis. The purpose of the issue is to fund some of the company's temporary borrowings.

Yarrow & Co., Ltd., have received the consent of the Capital Issues Committee to a one-for-three scrip issue. The new 150,000 £1 shares will rank *pari passu* in all respects with the existing ordinary shares, except that they will not rank for any dividends declared for the year ended 30th June last.

Elliott Brothers (London) and A.I.P. Merger.—It is announced by Elliott Brothers (London), Ltd., that negotiations with Associated Insulation Products, Ltd., have reached an advanced stage for the merging of the interests of the two companies. An offer is proposed of one Elliott 5s share for one A.I.P. share of 5s. A further announcement will be made as soon as the negotiations are completed.

The Superheater Co., Ltd., has announced an interim dividend of 10 per cent (unchanged).

The Telephone & General Trust, Ltd., is paying an interim dividend of 3 per cent (unchanged). The new shares issued in July do not rank for this interim dividend.

John Thompson, Ltd., have declared an interim dividend of 10 per cent (unchanged).

Thomas Bolton & Sons, Ltd., are paying an interim dividend of 2½ per cent (unchanged).

New Companies

James Whiteford & Co., Ltd.—Registered in Edinburgh on 24th August. Capital £60,000. Wholesale distributors, merchants, and manufacturers of all forms of radio, television, telecommunication, sound relay, etc. Directors: W. G. Whiteford and Mrs. F. Whiteford. Regd. office: 76, West Regent Street, Glasgow, C2.

Brainson Service, Ltd.—Registered 9th August. Capital £2,000. Electronic engineers, manufacturers and repairers of and dealers in apparatus partly or entirely composed of or controlled by electronic devices, etc. Directors: A. E. Brain, Dorothy Brain and L. Ingram. Regd. office: 3, Copperfield Road, Coventry.

Piezo-Ceramics, Ltd. — Registered 17th August. Capital £100. Manufacturers of and dealers in piezo ceramic elements, insulators, devices and materials, etc. Solicitors: Clifford-Turner and Co., 11, Old Jewry, London, E.C.2.

Minchom Lalewicz, Ltd.—Registered 15th August. Capital £100. Manufacturers of and dealers in electronic or electrical devices, apparatus or systems, etc. Directors: R. I. Minchom and S. W. Lalewicz. Sec.: Maria A. Lalewicz. Regd. office: 39-41, New Broad Street, E.C.2.

Flann Microwave Instruments, Ltd. — Registered 15th August. Capital £100. Radar, radio and electronic engineers, etc. B. Fleming is the first director. Sec.: A. J. Richards. Regd. office: 133, Munster Road, Teddington, Mdx.

R. R. Clark (Electronics), Ltd.—Registered 29th August. Capital £1,000. Manufacturers of and dealers in industrial and domestic electronic and electrical equipment, etc. R. R. Clark is the first director. Regd. office: 43, Upper Berkeley Street, W.1.

Walter (Sales), Ltd.—Registered 29th August. Capital £100. Electrical contractors, manufacturers, wholesalers, distributors, importers and repairers of and dealers in electrical goods, including dynamos, armatures, etc. Directors: J. H. W. Lewis and R. E. Clare. Regd. office: 135, West Coker Road, Yeovil, Som.

Walter (Tape Recorders), Ltd.—Registered 29th August. Capital £100. Objects and other particulars are similar to Walter (Sales), Ltd. (q.v.).

Family Television (Aigburth), Ltd.—Registered 19th September. Capital £100. C. R. P. Stonor is the first director. Regd. office: Duracraft Works, Franklin Road, Portslade, Sussex.

Family Television (Anfield), Ltd.—Registered 19th September. Capital £100. Particulars are similar to those of Family Television (Aigburth), Ltd. (q.v.).

Family Television (Bootle), Ltd.—Registered 19th September. Capital £100. Particulars are similar to those of Family Television (Aigburth), Ltd. (q.v.).

Alka Electronics (London), Ltd.— Registered 27th August. Capital £100. Directors: I. Woolf, A. Woolf, and K. N. Saigal. Secretary: A. Woolf. Regd. office: 52-4, Gray's Inn Road, London, W.C.1.

Knight & Goble, Ltd.—Registered 27th August. Capital £200. Electrical engineers and general electrical installation contractors, etc. Permanent directors: H. C. Goble and R. H. Knight. Secretary: Florence Knight. Regd. office: 3, Lincoln Court, South Street, Lancing, Sussex.

Wholesale Electrical Distributors (London), Ltd.—Registered 5th September. Capital £1,000. Directors: T. W. Wexler, A. Massey, R. Silver, S. Kittler and M. Driver. Regd. office: Vergers House, Shoreditch Church, London, E.1.

A. & R. Williams, Ltd.—Registered 11th September. Capital £1,500. To acquire the business of A. & R. Williams carried on by A. J. Williams at New Malden and to carry on the business of electrical engineers, etc. The first director is A. J. Williams. Regd. office: 4, Malden Road, New Malden, Surrey.

Johnson's Electricians, Ltd.—Registered 13th September. Capital £1,500. To acquire the business of electrical contractors carried on by B. E. Burdett and F. M. Wood as Johnson's Electricians, at Sheffield. Directors: B. E. Burdett and F. M. Wood. Regd. office: 101, Carver Street, Sheffield, 1.

Quality Electronics, Ltd.—Registered 18th September. Capital £1,000. Electrical engineers, general electrical and refrigeration installation contractors, manufacturers of and dealers in electronic and relay equipment, radio and television sets, etc. Directors: M. M. Toubkin, Mrs. Mary I. Toubkin and H. R. Pate. Regd. office: 47, High Street, Kingston-on-Thames, Surrey.

Pearlray Sales & Services, Ltd.—Registered 14th September. Capital £1,000. Hirers, service and maintenance engineers, manufacturers of and dealers in neon installations, signs, etc. Regd. office: 46, Market Place, Reading.

Guest Electrical Co., Ltd.—Registered 14th September. Capital £2,000. To acquire the business of an electrical, radio and television engineer and contractor carried on by R. J. Guest at Lewes, Sussex, as Guest Electrical Co., etc. Directors: R. J. Guest (chairman) and Jean C. Guest. Regd. office: 73a, North Street, Lewes, Sussex.

Electronic Communications, Ltd.—Registered 14th September. Capital £100. Dealers in and manufacturers of machinery of all kinds, mechanical, electrical, automobile, hydraulic, pneumatic, electronic and general engineers, etc. Directors: K. W. G. Webb and Mrs. Barbara Webb. Regd. office: 66, Victoria Street, S.W.1.

Mepham Electrical Co., Ltd.—Registered 14th September. Capital £1,000. Electrical, radio, television and refrigeration engineers and contractors, etc. Regd. office: 107, Whitecross Street, E.C.1.

Autotrol, Ltd.—Registered 14th September. Capital £100. Manufacturers, designers and repairers, fitters and hirers of and dealers in electrical, mechanical, electronic and atomic apparatus and accessories, etc. Directors: K. N. Endean and Lilian Summerlin. Regd. office: 3, The Quadrant, Richmond, Surrey.

Rochford Electrical Co., Ltd.—Registered 12th September. Capital £1,000. Electrical engineers and contractors, etc. Directors: Mrs. Margaret M. Kilby and J. A. White. Regd. office: 69, Main Road, Hockley.

Renovac Electrics, Ltd.—Registered 10th September. Capital £400. Manufacturers of and dealers in electrical plant and machinery, etc. Directors: W. H. Norris and Mrs. Freda B. Norris. Regd. office: Long Acre, Bridge Road, Maidenhead, Berks.

Cragg Electrical Service, Ltd.—Registered 2nd August. Capital £100. Electrical and mechanical engineers, etc. Directors: L. C. Cragg and Mrs. Violet E. Cragg. Regd. office: 16, Addington Road, West Wickham, Kent.

Bankruptcies

A. E. Thompson, 9, High Row, Darlington, and Clark's Yard, High Row, Darlington, electrical engineer and contractor.—First and final dividend of 11¼d in the £, payable on and after 5th October at the Official Receiver's office, 4, Bridge Road, Stockton-on-Tees.

R. J. Camden, 32½ New Bridge Street, Exeter, electrical engineer.—Second and final dividend of 1s 8¾d in the £, payable on and after 12th October at the offices of Edward Thomas Collins & Son, 28, Baldwin Street, Bristol, 1.

B. J. Wheldon, 336, Londonderry Road, Langley, Oldbury, Worcs, electrical and radio salesman.—Order of adjudication dated 17th March, 1939, annulled and receiving order dated 17th March, 1939, rescinded on 12th September, on the grounds that the costs, fees, charges and expenses of the bankruptcy and the debts of the debtor have been, or will be, paid in full.

N. W. Sparrow, residing and formerly carrying on business at Shard Lane End, Little Singleton, near Blackpool, as an electrical contractor.—Public examination 21st November at the Court House, South King Street, Blackpool.

H. Harding, 15c, Mill Lane, Macclesfield, Ches., electrical contractor.—Last day for receiving proofs for dividend 9th October. Trustee, Mr. F. C. Ormrod, 12, Lonsdale Street, Stoke-on-Trent, Official Receiver.

Liquidation

Geo. Andrews & Co., Ltd., electrical engineers.—Last day for receiving proofs for dividend 9th October. Liquidator, Mr. W. A. Mountain, Old Post Office Chambers, Skegness.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 0d each including postage) will be obtainable after 10th October from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1951

21634. Western Electric Co., Inc.—Semiconductor electric signal translating devices and methods of making them. 14th September, 1951. (759012.)

1953

48. Compagnie des Freins et Signaux Westinghouse.—Manufacture of rectifiers of the dry type. 1st January, 1953. (758814.)

3427. Southern United Telephone Cables, Ltd.—Production of metal tubing by extrusion. 5th February, 1954. (759017.)

4479. Etzkorn, W. V.—Luminous electric discharge bodies. 17th February, 1953. (758915.)

10053. Metropolitan-Vickers Electrical Co., Ltd.—Electric voltage multiplier circuits. 12th April, 1954. (758645.)

10593. Cable Makers Properties, Ltd.—Electric communication cables. 20th November, 1953. (758815.)

12453. Pye, Ltd.—Television relay systems. 5th May, 1954. (759023.)

13580. National Research Development Corporation.—Electromechanical transducers and systems incorporating same. 6th May, 1954. (758647.)

15617. Permutit Co., Ltd.—Electrolytic cells and membranes for use therein. 24th May, 1954. (Cognate application 15618, 5th June, 1953.) (758650.)

15699. Communications Patents, Ltd.—Dielectric heating apparatus. 8th September, 1954. (759025.)

17076. Diamond H Switches, Ltd.—Electrical terminals. 8th June, 1954. (758921.)

17725. Electric & Musical Industries, Ltd.—Electric condensers. 28th June, 1954. (759026.)

18016. Hoover, Ltd. (Hoover Co.).—Electric irons. 24th June, 1954. (759027.)

18078. Electric & Musical Industries, Ltd.—Scanning circuits. 30th June, 1954. (758922.)

22255. Marconi's Wireless Telegraph Co., Ltd.—Television cameras. 3rd June, 1954. (759032.)

22335. Henley's Telegraph Works Co., Ltd., W. T., and Davis, W. C.—Methods of forming members with interrupted screw threads, applicable to electrical line taps. 13th August, 1953. (758828.)

24413. British Thomson-Houston Co., Ltd.—Electrical selective position control systems. 30th August, 1954. (758725.)

24679. Philips Electrical Industries, Ltd.—Magnetic systems for use with electron beams. 7th September, 1953. (758930.)

25552. Wolseley Engineering, Ltd., and Macnamara, H. J.—Insulator for electric wire fencing. 1st December, 1954. (758832.)

25968. Svenska Aktiebolaget Gasaccumulator.—Arrangement in constructions for automatic radio direction finding. 21st September, 1953. (758727.)

25997. National Research Development Corporation.—High frequency heating apparatus. 20th September, 1954. (759038.)

26274. Electric & Musical Industries, Ltd.—Inductance charging circuits. 24th September, 1954. (758931.)

26850. Babcock & Wilcox, Ltd.—Forced flow, once-through tubulous vapour generating and superheating units and a method of regulating temperature of superheat. 29th September, 1954. (758833.)

27059. Northrop Aircraft, Inc.—Electrical discharge devices. 2nd October, 1953. (758834.)

29445. North, N. E., and North, M.—Electrically heated blankets, overlays or pads. 20th October, 1954. (758935.)

30667. British Thomson-Houston Co., Ltd.—Electrical control circuits. 25th October, 1954. (758729.)

30812. General Electric Co., Ltd., and Donelan, J. A.—Methods of welding. 22nd October, 1954. (758840.)

31411. Siemens-Schuckertwerke Akt.-Ges.—Instruments for measuring magnetic fields. 12th November, 1953. (759047.)

31708. Ballard, E. H. A., and Hay, H. J.—Electrical space heaters. 3rd January, 1955. (759049.)

32591. British Thomson-Houston Co., Ltd.—Electric lanterns for street lighting and like purposes. 19th October, 1954. (758734.)

32989. Kelvin & Hughes, Ltd.—Means for indicating and/or controlling a variable. 29th November, 1954. (758672.)

33816. British Thomson-Houston Co., Ltd.—Luminescent materials of phosphors. 6th December, 1954. (758940.)

34410. Telephone Manufacturing Co., Ltd.—Telephone apparatus. 10th December, 1953. (758737.)

35645. Marconi's Wireless Telegraph Co., Ltd.—Electronic switching arrangements. 19th October, 1954. (758740.)

35703. English Electric Co., Ltd.—Actuating mechanisms for removable covers. 23rd December, 1954. (758741.)

35927. Hughes Aircraft Co.—Electron storage tube. 24th December, 1953. (758677.)

1954

1778. Falk, Stadelmann & Co., Ltd.—Mounting electrical connectors. 21st January, 1955. (758945.)

2619. Naamlooze Vennootschap Fabriek van Electrische Apparaten voor Heen F. Hazemeijer & Co.—A.c. electric circuit-breaker having an arc control device. 28th January, 1954. (758947.)

2710. Napier & Son, Ltd., D.—Electrical surface heating apparatus. 21st January, 1955. (758948.)

2992. Telefonaktiebolaget L. M. Ericsson.—Relay selectors and cross bar switches. 1st February, 1954. (758949.)

4030. Plessey Co., Ltd.—Indexing means for rotary electric switches. 11th February, 1955. (758950.)

4967. Standard Telephones & Cables, Ltd.—Equipment for driving and stopping a magnetic tape. 19th February, 1954. (759066.)

5324. British Thomson-Houston Co., Ltd.—Turbines. 21st February, 1955. (758852.)

5352. Compagnie Générale de Télégraphie sans Fil.—Linear accelerators. 23rd February, 1954. (758853.) 5353. Linear accelerators for charged particles. 23rd February, 1954. (758854.)

6481. Stackpole Carbon Co.—D.c. electric switching contacts. 5th March, 1954. (758953.)

6933. Siemens Bros. & Co., Ltd.—Thermionic valve circuits. 4th March, 1955. (758857.)

8813. Union Carbide & Carbon Corporation.—Electric arc spot or tack welding. 25th March, 1954. (758687.)

8483. British Thomson-Houston Co., Ltd.—Ultra-high-frequency aerials. 24th March, 1955. (758957.)

8925. Standard Telephones & Cables, Ltd.—Cathode-ray information stores. 26th March, 1954. (758861.)

9232. Hill, J. W.—Electrical engraving machines. 29th June, 1955. (759074.)

9440. Western Electric Co., Inc.—Apparatus for welding contacts on to wires of electrical relay components. 31st March, 1954. (759076.)

9530. Cole, Ltd., E. K., White, J. H., and Wilson, F. C.—Coaxial control knobs. 1st April, 1955. (759078.)

9925. Skillman & Co., Pty., Ltd., T. S.—Printed circuit arrangements. 5th April, 1954. (758688.)

10368. Philips Electrical Industries, Ltd.—Cylindrical anisotropic permanent magnets. 8th April, 1954. (758962.)

10565. British Broadcasting Corporation.—Delaying of television signals. 12th April, 1955. (758865.)

10618. Walsall Conduits, Ltd.—Flameproof electric switchgear. 12th April, 1955. (758963.)

10740. General Electric Co.—Electric motor control devices for refrigerators. 12th April, 1954. (758866.)

11698. British Thomson-Houston Co., Ltd.—Wedges for the winding slots of dynamo-electric machines. 20th April, 1955. (758964.)

11988. Philips Electrical Industries, Ltd.—Devices embodying cavity resonators. 26th April, 1954. (758966.)

12327. British Thomson-Houston Co., Ltd.—Interior coating of lamp bulbs and the like. 28th April, 1954. (758968.)

12558. Ateliers de Constructions Electriques de Charleroi.—Electric remote-control positioning system. 30th April, 1954. (758765.)

14193. Philips Electrical Industries, Ltd.—Devices for controlling the welding times and intervals in resistance welding apparatus. 14th May, 1954. (758971.)

14734. British Insulated Callender's Cables, Ltd.—Electric cable. 18th May, 1955. (Addition to 716826.) (758878.)

15333. Hawes Electric, Ltd.—Electric switches for domestic appliances. 24th May, 1955. (758975.)

17178. Chromatic Television Laboratories, Inc.—Damp rod construction for cathode-ray tube grid structure. 11th June, 1954. (758770.)

17509. Standard Telephones & Cables, Ltd.—Electrical terminal blocks. 15th June, 1954. (758977.)

17530. Borg-Warner Corporation.—Devices for securing an electrical cable to an electrical appliance so as to relieve strain. 15th June, 1954. (758978.)

19297. Clarostat Mfg. Co., Inc.—Rotor for a potentiometer. 1st July, 1954. (758779.)

20235. D. S. Plugs, Ltd.—Pins of electric plug and socket connectors. 1st February, 1955. (759103.)

20482. General Electric Co.—Automatic ice maker. 13th July, 1954. (758982.)

20932. Marconi's Wireless Telegraph Co., Ltd.—Self-orientating radio direction finders. 26th April, 1955. (758983.)

21086. Westinghouse Air Brake Co.—Electromagnetic relays. 20th July, 1954. (758782.)

21405. Coulson, J. F.—Electric circuit protecting switches. 22nd July, 1954. (758985.)

21587. Standard Telephones & Cables, Ltd.—Capacitors having electrodes formed of metallised dielectric strips. 23rd July, 1954. (758784.)

23258. Elektriska Svetsningsaktiebolaget.—Manufacture of electrical condensers. 10th August, 1954. (759108.)

24463. Philips Electrical Industries, Ltd.—Automatic gain control circuits for use in television receivers. 23rd August, 1954. (758988.)

24467. Belling & Lee, Ltd.—Aerial systems. 31st May, 1955. (758794.)

25765. Standard Telephones & Cables, Ltd.—Dry contact type rectifiers. 6th September, 1954. (758990.)

26035. General Electric Co.—Semi-conductor amplifiers. 8th September, 1954. (758991.)

27538. Siemens & Halske Akt.-Ges.—Circuit arrangements including electron tubes for very short waves. 23rd September, 1954. (758797.)

[Continued at foot of next page

NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged

Sunday, 7th October, to Friday, 12th October

MANCHESTER.—Manchester Association of Engineers. Centenary celebrations.

Monday, 8th October

BIRMINGHAM.—Regent House, St. Philip's Place, Colmore Row, 6 p.m. I.E.E. South Midland Supply & Utilisation Group. "Germanium and Silicon Power Rectifiers," by T. H. Kinman, G. A. Carrick, R. G. Hibberd and A. J. Blundell.

BRISTOL.—Engineering Laboratories, University Walk, 6 p.m. I.E.E. Western Centre. Chairman's address, by Dr. G. H. Rawcliffe.

IPSWICH.—Crown & Anchor Hotel, 6 for 6.30 p.m. I.E.E. East Anglian Sub-Centre. Chairman's address, by J. A. Sumner.

LONDON.—At the Institution of Electrical Engineers, Savoy Place, 5 p.m. Institution of Post Office Electrical Engineers, London Centre Jubilee meeting. President's address, "Fifty Years of Telecommunications," by Brig. L. H. Harris.

White Hall Hotel, Bloomsbury Square, W.C.1, 7.30 p.m. A.S.E.E. Central London Branch. "Relays and Automatic Control in Industry," by Dr. W. L. Stern.

MALVERN.—Winter Gardens. I.E.E. South Midland Centre, district meeting. "Highland Water Power."

MANCHESTER.—Engineers' Club, Albert Square, 7.30 p.m. Junior Institution of Engineers, North-Western Section. Annual general meeting and president's address.

NEWCASTLE-UPON-TYNE. — Neville Hall, 6.15 p.m. I.E.E. North-Eastern Centre. Chairman's address, by J. Christie.

SHEFFIELD.—Livesey Clegg House, 44, Union Street, 7.30 p.m. Junior Institution of Engineers, Sheffield & District Section. Chairman's address and annual meeting.

The University, Western Bank, 6.30 p.m. I.E.S. Sheffield Centre. Chairman's address, by F. A. Benson.

Grand Hotel, 7 for 7.30 p.m. Institution of Production Engineers, East & West Ridings Region, Sheffield Section. Annual dinner.

SOUTHAMPTON.—A.S.E.E. Oxford, Reading & Districts Branch. Visit to electrical and mechanical installations, Southampton Docks.

WEMBLEY PARK.—Century Hotel, Forty Avenue, 8.15 p.m. A.S.E.E. North West London Branch. "Automatic Temperature Controls," by D. H. Powell.

Tuesday, 9th October

BELFAST.—Queen's University, 6.30 p.m. I.E.E. Northern Ireland Centre. Chairman's address, "A Few Remarks about Switchgear," by D. Parry.

BOURNEMOUTH. — Grand Hotel, Firvale Road, 8 p.m. A.S.E.E. Bournemouth Branch. "Estimating," by W. H. Brooks.

CAMBRIDGE. — Cambridgeshire Technical College, Collier Road, 6 p.m. I.E.E. Cambridge Radio & Telecommunication Group. Chairman's address, by J. G. Yates.

EDINBURGH.—11, Atholl Crescent, 7.30 p.m. Edinburgh Electrical Society. Presidential address, by V. P. Mackay.

LIVERPOOL.—9, The Temple, 24, Dale Street, 6 p.m. I.E.S. Liverpool Centre. Chairman's address, by F. J. Burns.

LONDON.—Savoy Place, 5.30 p.m. I.E.E. Measurement & Control Section. Chairman's address, "The Measurement of Radioactivity," by Dr. D. Taylor.

At the Royal Institution, Albemarle Street, 6 p.m. Illuminating Engineering Society. Presidential address, "Lighting and Social History," by W. E. Harper.

Connaught Rooms, W.C.2, 12.30 for 1 p.m. Electrical Industries Club. Luncheon. Guest speaker, Sir John Maud.

Royal Festival Hall, 9.45 a.m. Incorporated Sales Managers' Association. Conference. Discussion on "Can We Sell our Way out of Inflation?"

LOUGHBOROUGH.—The College, 7 p.m. I.E.E. East Midland Centre. Chairman's address, by Dr. H. L. Haslegrave, followed by annual general meeting.

MANCHESTER. — Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North-Western Utilisation Group. "Mine Locomotives," by T. E. Green.

College of Technology, 7.30 p.m. Society of Instrument Technology, Manchester Section. Presidential visit and informal discussion.

RUGBY.—College of Technology & Arts, 6.30 p.m. I.E.E. Rugby Sub-Centre. Chairman's address, "Power for Transport," by J. H. Cansdale.

Wednesday, 10th October

ABERDEEN.—Caledonian Hotel, 7.30 p.m. I.E.E. North Scotland Sub-Centre. Centre chairman's address, by Prof. F. M. Bruce. (Preceded at 6 p.m. by an informal dinner.)

BIRMINGHAM. — James Watt Institute, 6.30 p.m. I.E.E. South Midland Graduate & Student Section. Chairman's address, by A. H. Boyson.

Exchange & Engineering Centre, Stephenson Place, 7.30 p.m. A.S.E.E. Birmingham Branch. "Valves for Industry," by R. G. Roach.

DUNDEE.—New Imperial Hotel, 15, Tally Street, 7.30 p.m. Institution of Production Engineers, Scottish Region, Dundee Section. "Machine Tools from Wilkinson to Automation," by R. Gabriel.

FARNBOROUGH.—R.A.E. Technical College, 7.30 p.m. I.E.E. Southern Centre. "An On-Off Servomechanism with Predicted Changeover," by J. F. Coales and A. R. M. Norton.

HALIFAX.—Crown Hotel, Horton Street, 7.30 p.m. A.S.E.E. Halifax Branch. "Industrial Instruments," by J. Collinge, followed by film.

HATFIELD.—Technical College, 7 p.m. I.E.E. district meeting. "Nuclear Instrumentation," by W. Abson.

LANCASTER. — N.W.E.B. Demonstration Theatre, North Road, 7.15 p.m. I.E.E. North Lancashire Sub-Centre. Chairman's address, by E. H. Scholes.

LONDON.—Savoy Place, W.C.2, 6.30 p.m. I.E.E. London Graduate & Student Section. Chairman's address, "The Story of the Submarine Cable," by K. W. E. Gravett.

MANCHESTER. — Engineers' Club, Albert Square, 6.45 p.m. I.E.E. North-Western Radio & Telecommunication Group. Informal lecture on "The Generation and Synthesis of Music by Electrical Means," by A. Douglas.

At Ferranti, Ltd., Moston, 7 p.m. I.E.E. North-Western Graduate & Student Section. "Heat Pumps," by B. Z. de Ferranti.

NOTTINGHAM. — "Three Horse Shoes," Derby Road. A.S.E.E. Nottingham Branch. Social evening.

OXFORD.—37, George Street, 7 p.m. I.E.E. district meeting. "Transatlantic Telephone Cable," by Dr. M. J. Kelly, Sir Gordon Radley, G. W. Gilman and R. J. Halsey.

WOLVERHAMPTON. — Wolverhampton & Staffordshire Technical College, Wulfruna Street, 7.15 p.m. British Institution of Radio Engineers, West Midlands Section. "Colour Television."

Wednesday, 10th October, to Friday, 12th October

LONDON. — Royal Horticultural Society's New Hall, Westminster. Engineering Industries Association, 9th London Regional Display.

Thursday, 11th October

DUNDEE.—Queen's College, 7 p.m. I.E.E. North Scotland Sub-Centre. Centre chairman's address, by Prof. F. M. Bruce.

GLASGOW.—39, Elmbank Crescent, 7 p.m. British Institution of Radio Engineers, Scottish Section. "The Digital Computer and its Applications," by Dr. Barnett.

HULL. — Y.E.B., Ferensway, 7.15 p.m. I.E.E. North Midland Centre, district meeting. "Protection of Electrical Supply Networks," by E. G. Hopper. (Joint meeting with the North Midland Graduate & Student Section.)

LEICESTER.—Bell Hotel, 7 p.m. Institution of Production Engineers, North Midlands Region, Leicester Section. "Ultrasonic Machining of Hard Materials," by C. F. Broklesbury.

LONDON.—Savoy Place, 5.30 p.m. I.E.E. Utilisation Section. Chairman's address, "Balanced Development and Diversity of Applications," by H. J. Gibson.

Prince of Wales Hotel, S.W.19, 7.30 p.m. A.S.E.E. South West London Branch. "The Electrical Branch of the Royal Navy," by Cmdr. P. A. Watson, R.N.

SOUTHSEA.—Royal Beach Hotel, 8 p.m. A.S.E.E. Portsmouth Branch. "Motor Control Gear," by R. F. Mathieson.

SWANSEA.—South Wales Electricity Board, The Kingsway, 6 p.m. I.E.E. West Wales (Swansea) Sub-Centre. Chairman's address, by J. L. Griffiths.

Friday, 12th October

CREWE.—Royal Hotel, 7.30 p.m. A.S.E.E. Stoke & Crewe Branch. "Space Heating by Electricity," by K. G. Stephenson.

LONDON.—Caxton Hall, S.W.1, 6.30 p.m. E.P.E.A. Southern Meter Engineers' Technical Group. "Electricity and Russia," by D. B. Irving.

Friday, 12th October, to Sunday, 14th October

BOURNEMOUTH.—Grand Hotel. Incorporated Plant Engineers. Southern regional conference.

Saturday, 13th October

LONDON.—I.E.E. London Graduate & Student Section. Visit to E.M.I. Studios, Ltd., Abbey Road, N.W.8, at 10 a.m.

A.S.E.E. South West London Branch. Morning visit to Industrial Safety Centre, Horseferry Road, S.W.1.

NEW PATENTS *(concluded)*]

27887. Gaylord Products, Inc.—Speed-responsive electric switches. 27th September, 1954. (758992.)

28257. Ingeniorsfirman Magnetic Aktiebolag.—Arrangements for automatically and continuously measuring the noise factor of an electric device. 30th September, 1954. (758994.)

28688. Pellizzari & Figli Soc. Per Azioni. —Air cooled mercury current convertor. 5th October, 1954. (758995.)

29342. Schurecht, H. G.—Electrically semi-conducting ceramic body. 12th October, 1954. (758997.)

30856. Western Electric Co., Inc.—Production of semi-conductor bodies. 26th October, 1954. (759002.)

33115. Standard Telephones & Cables, Ltd.—Stepping circuit arrangement using two-terminal trigger devices. 16th November, 1954. (Addition to 727415.) (759005.)

33172. Philips Electrical Industries, Ltd. —Tubular lamps. 16th November, 1954. (759125.)

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia.—10th October. State Electricity Commission of Victoria. Electricity meters. (E.S.B. 24301/56. Ten/21648.)*

22nd October. Electricity Commission of New South Wales. 30,000 kVA voltage regulator. (E.S.B. 24118/56. Ten/21678.)* 12th November. Circuit-breakers, isolating switches and transformers. (E.S.B. 24119/56. Ten/21689.)*

13th November. Director, Posts and Telegraphs, G.P.O., Melbourne. Loading coils. (E.S.B. 24302/56. Ten/21726.)*

Brazil.—23rd October. Comissao Estadual de Energia Elétrica. 69 kV transmission lines between Venancio Aires and Lajeado. (E.S.B. 23098/56. Ten/21709.)*

Burma.—17th October. Union Purchase Board, Rangoon. Fluorescent lamps and fittings. (E.S.B. 24151/56. Ten/21599.)* 22nd October. Cable. (E.S.B. 24153/56. Ten/21634.)* Lamp holders. (E.S.B. 24161/56. Ten/21607.)* 23rd October. Electric wire. (E.S.B. 24191/56. Ten/21641.)* 24th October. Three-way plugs. (E.S.B. 24202/56. Ten/21684.)* Fluorescent fittings. (E.S.B. 24204/56. Ten/21686.)*

Chertsey.—11th October. U.D.C. Street lighting equipment. Surveyor, Council Offices, Guildford Street.

Edinburgh.—North of Scotland Hydro-Electric Board. Telephone type multi-core cables and 132 kV steel tower overhead transmission line. (See this issue.)

Formosa.—24th October. Central Trust of China, Purchasing Department. Transformers. (E.S.B. 24334-5/56.I.C.A. Ten/21660-1.)* 25th October. Control gear. (E.S.B. 24336/56.I.C.A. Ten/21677.)* 26th October. Capacitors and voltage regulators. (E.S.B. 24338/56.I.C.A. Ten/21662.)* Twenty-two 69 kV and seventeen 34·5 kV power circuit-breakers. (E.S.B. 24337/56. I.C.A. Ten/21666.)* Reclosers, sectionalisers, fuse cutouts, etc. (E.S.B. 24339/56. I.C.A. Ten/21688.)* 27th October. Power cables and cable heads. (E.S.B. 24340/56. I.C.A. Ten/21663.)* 29th October. Air-break switches, power fuses, etc. (E.S.B. 24584/56.I.C.A. Ten/21727.)* Cables and cable accessories. (E.S.B. 24583/56.I.C.A. Ten/21742.)* 30th October. Electrical measuring and testing instruments. (E.S.B. 24587/56.I.C.A. Ten/21741.)*

India.—30th October. Director General of Supplies and Disposals. Cable. (E.S.B. 24317/56. Ten/21705.)* 31st October. Paper insulated lead alloy cable. (E.S.B. 24316/56. Ten/21691.)*

16th October. India Supply Mission, Washington. Electrical apparatus including a coil winding machine, armature baking oven, battery charger, welding generator, melting furnace, etc. (E.S.B. 24685/56.I.C.A. Ten/21747.)*

Iraq.—10th December. Directorate General of Legal Affairs and Contracts. Electrical supply for operators' camp, Derbendi Khan Project, including generators, power lines, street lighting, etc. (re-issue of tender). (E.S.B. 24397/56. Ten/17696B.)*

Irish Republic.—16th October. Eire Commissioners of Public Works. Electrical installation in Dundrum Asylum, Co. Dublin. J. Tyrrell, secretary, Office of Public Works, 51, St. Stephen's Green, Dublin.

London.—17th October. Wandsworth Borough Council. Five battery chargers for electric vehicles. (See this issue.)

New Zealand.—23rd October. General Post Office. 50 Milliammeters. (E.S.B. 23955/56. Ten/21635.)* 30th October. Sweep generator and electronic multi-meter. (E.S.B. 24352/56. Ten/21698.)*

26th October. Auckland Electric Power Board. Aerial cable. (E.S.B. 24033/56. Ten/21645.)*

Pakistan.—24th October. Director General Posts and Telegraphs. Underground cables. (E.S.B. 24432/56. Ten/21690.)*

Rhodesia and Nyasaland.—19th October. Director of Medical Services. Electro-surgical diathermy apparatus. (E.S.B. 24463/56. Ten/21714.)*

21st November. Bulawayo Electricity Department. Transformers and overhead line material. (E.S.B. 24371/3/56. Ten/21732-3.)*

Ryton-on-Tyne.—U.D.C. Electrical installations in 86 houses being erected near Runhead Gardens, Ryton. Surveyor, Council Offices, Ryton Tower, Ryton.

South Africa.—18th October. Union Tender and Supplies Board. Telephone switchboard spares. (E.S.B. 23893/56. Ten/21571.)* 25th October. Motors, starters, meters and hand tools. (E.S.B. 24566/56. Ten/21719.)* Tubular glass fuses. (E.S.B. 24569/56. Ten/21720.)* Dial mounting assemblies, plugs and jacks. (E.S.B. 24570/56. Ten/21744.)*

24th October. Stores Department, South African Railways. Floodlight lanterns and lighting fittings. (E.S.B. 24214-5/56. Ten/21631-2.)* 26th October. Overhead track equipment fittings. (E.S.B. 24217/56. Ten/21647.)* Armature rewinding wire. (E.S.B. 24219/56. Ten/21680.)* Telegraph line material and steel poles. (E.S.B. 24216/56. Ten/21683.)* Telegraph line material. (E.S.B. 24220/56. Ten/21735.)*

Southend-on-Sea.—22nd October. Borough Council. Cabling for Prittlewell sewage works. (See this issue.)

Southern Rhodesia.—7th November. City of Bulawayo, Electricity Department. House service meters. (E.S.B. 24374/56. Ten/21679.)*

Sunderland.—18th October. Town Council. Electrical installations in Farringdon Junior and Infants' Schools. Borough architect, Grange House, Stockton Road.

Taunton.—22nd October. Borough Council. Electrical goods (Schedule D) for one year from 1st January, 1957. K. A. Horne, town clerk, Municipal Buildings.

United States.—25th October. Bureau of Reclamation. 6,300 h.p. hydraulic turbine for Big Thompson power plant, Colorado. (E.S.B. 22841/56. Ten/21636.)* One 23,500 h.p. hydraulic turbine and governor. (E.S.B. 23650/56. Ten/21730.)* 6th November. 230/161 kV auto-transformer for Sioux City substation. (E.S.B. 24267/56. Ten/21758.)*

13th November. Corps of Engineers, U.S. Army. Seven 128,500 h.p. Francis type hydraulic turbines. (E.S.B. 23605/56. Ten/21675.)*

Uruguay.—31st October. Administration General de las Usinas Eléctricas y los Teléfonos del Estado. Underground armoured cables and boxes. (E.S.B. 23683/56. Ten/21626.)* 1st November. Armoured cables. (E.S.B. 23682/56. Ten/21637.)* 6th November. Braided plastic-covered double conductor. (E.S.B. 23681/56. Ten/21669.)* 8th November. Radio telephonic equipment. (E.S.B. 23776/56. Ten/21713.)* 7th November. Valves for radio-telephone equipment. (E.S.B. 23775/56. Ten/21739.)*

Winchester—31st October. City Council. Street lighting equipment. (See this issue.)

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Birmingham. — Two- and three-storey dwellings (96) on Welsh House Farm estate, Harborne and shops with dwellings over (14), Westcote Avenue, Egghill Lane estate, Northfield; A. G. Sheppard Fidler, city architect, Civic Centre, 1.

Bromsgrove.—College of Further Education, Well Lane; Wm. Cooper & Son, Ltd., builders, West Street, Blackheath, Staffs.

Conisborough.—Houses (70), at Old Road; G. Chadwick, U.D.C. surveyor, 5, High Street, Conisborough, Doncaster.

Durham.—Men's college at Durham University (£325,000); T. Worthington and Sons, architects, Oxford Road, Manchester.

Science block at Durham University (£360,000); Easton and Robertson, architects, 53, Bedford Square, London, W.C.1.

Police houses (22) at Lanchester, Hartlepool and Newton Aycliffe; county architect, South Street, Durham.

Enfield.—Four-storey offices in Millmarsh Lane, for Enfield Rolling Mills; F. Shearley, architect, 27, Kymberley Road, Harrow.

Essex.—Second instalment of Thurrock Technical College (£200,000); extensions to Ardleigh House, Hornchurch (£60,000); printing department at South East Essex Technical College, Barking (£47,000); H. Conolly, county architect, County Hall, Chelmsford.

Hull.—Houses (130), Mollison Road, Hessle; Stan Spruit, Ltd., 609, Holderness Road.

Huntingdon.—Scheme for 1,000 houses, schools, factories, etc. (in connection with L.C.C. and Hunts C.C.); borough engineer, 89, High Street.

Lancaster.—Reconstruction of emporium, Market Square; Lancaster & District Co-operative Society, Ltd., Church Street.

London.—Offices, High Holborn and Great Turnstile; Morrison, Rose & Partners, architects, 4, Wimpole Street, W.1.

Offices, 75-9, York Road, Lambeth; G. Lee, surveyor, 88, Gray's Inn Road, W.C.1.

Dwellings (62), Forest Street, West Ham; A. E. Symes, Ltd., builders, High Street, E.15.

Newcastle-on-Tyne.—First two office blocks of new Town Hall in Barras Bridge (£2,500,000); G. Kenyon, city architect.

Newport (I.O.W.). — Grammar/technical school at Gunville; county architect, County Hall.

North Riding.—Second phase of Cleveland Technical College, Redcar (£209,600); county primary schools at Stokesley and Nunthorpe; county architect, County Hall, Northallerton.

Port Glasgow.—Houses (136), Whitcroft scheme (£240,000); burgh surveyor, Port Glasgow, Renfrewshire.

Raunds.—County infants' school; W. E. Cockerill & Sons, Ltd., 7, Milton Road, Northampton.

Southport.—High school for girls at Hillside; town planning officer, 99-105, Lord Street.

Sunderland.—R.C. school, Southwick (£42,350); first instalment of extensions to St. Bede Girls' School (£60,000); new school, Seaburn (£106,000); borough architect.

Tynemouth.—Conversion of Howard Hall, North Shields, into factory for Plastics and Metal Engraving Co., Ltd., Mason Avenue, Whitley Bay.